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ABSTRACT

This handbook is designed to identify classroom practices that research has shown to result in higher student achievement. The fundamental idea behind this book is that in order to succeed, efforts to improve instruction must foucs on the existing knowledge base about effective teaching and learning. The chapters are: (1) "Introduction" (Gordon Cawelti); (2) "Generic Practices" (Herbert J. Walberg); (3) "The Arts" (Richard Colwell); (4) "Foreign Language" (Myriam Met); (5) "Health Education" (Catherine D. Ennis); (6a) "Language Arts" (James R. Squire); (6b) "Oral Communication" (Carolyn Dunkle Perry); (7) "Mathematics" (Douglas A. Grouws); (8) "Physical Education" (Catherine D. Ennis); (9) "Science" (Dorothy Gabel); (10) "Social Studies" (James P. Shaver); and (11) "Focusing Staff Development on Student Learning" (Dennis Sparks). Each of the chapters follows a common format. After a brief introduction, 10 to 16 classroom practices are identified. A summary of research findings is presented, followed by an application to classroom practices. For the research-based practices identified, only the most important studies supporting those practices are cited. Although most studies rely on traditional kinds of achievement testing, a broader definition of achievement is used here. Integrated approaches within disciplines are included if they are judged appropriate. Each chapter contains a reference list of 60 to 90 items. (TM)

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ED 394 629

HANDBOOK OF RESEARCH ON IMPROVING STUDENT ACHIEVEMENT

Gordon Cawelti, Editor

Sponsored by Alliance for Curriculum Reform

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Gordon Cawelti, Editor
Sponsored by Alliance for Curriculum Reform

Published by Educational Research Service

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The opinions expressed in the *Handbook* are those of the authors. Inclusion of a specific instructional practice in the *Handbook* does not imply endorsement by the Educational Research Service, by ERS sponsoring organizations, or by member organizations of the Alliance for Curriculum Reform.

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Foreword

In 1990, educators from educational organizations and professional associations met in Aspen, Colorado, to begin discussions of educational reform related to curriculum and instruction. Two years of intense discussions resulted in the formation of the Alliance for Curriculum Reform (ACR), a membership organization composed of educational and disciplinary associations that represent nearly three million professionals—teachers, administrators, and researchers.

ACR members began meeting, in part, because they felt that together they could be more effective in addressing challenging curriculum issues facing education today. It is in this spirit that the *Handbook of Research on Improving Student Achievement* has been produced, thanks largely to the expert leadership of Gordon Cawelti, the first Executive Director of ACR, and the support of the Rockefeller Foundation.

ACR member organizations played an important role in the development of the *Handbook*. They supported the idea of the project, assisted with the selection of chapter authors, and provided advice and input on early drafts of the individual chapters and the introduction. It is important to note, however, that the chapters do not represent official positions of any individual disciplinary association, nor an official position of ACR, the Educational Research Service, or any ERS sponsoring organization.

The Educational Research Service (ERS) is pleased to publish the *Handbook* because of the publication's potential to make dependable and accurate research more accessible to local school district leaders for use in instructional decisions. Ever since ERS was established in 1973, a primary mission of the organization has been to promote research-based decision making in local schools and school districts by providing the research and information needed by school administrators, teachers, and other educators. The *Handbook of Research on Improving Student Achievement* represents a major contribution to this mission.

It is the hope of both ACR and ERS that teachers, administrators, and other educators will find the *Handbook* useful and relevant. We also hope that the inclusion of information from the various disciplines will inspire teachers and curriculum developers to look outside their own areas of expertise and to learn from and about the other discipline areas. We believe that the *Handbook* provides a basic framework from which solid interdisciplinary curricula can be built, leading to higher student achievement.

Denise McKeon, Immediate Past Chair
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Representing Teachers of English to
Speakers of Other Languages (TESOL)

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Acknowledgments

Publication of the *Handbook of Research on Improving Student Achievement* is the result of the serious interest and considerable effort of many people over the past two years. The knowledge base that this *Handbook* helps to establish would not have been possible without the financial support of the Rockefeller Foundation and the insight of Hugh B. Price, former Vice President, who saw the need for providing such information to teachers and other instructional leaders in clear and concise language.

The initial Advisory Panel for the *Handbook* met in May 1994, and provided valuable advice on the general format and procedures to be followed, as well as suggesting scholars to be invited to contribute to the *Handbook*. Panel members included Herb Walberg of the University of Illinois at Chicago; Robert Slavin of The Johns Hopkins University; Dennis Sparks of the National Staff Development Council; Thomas Romberg of the University of Wisconsin; Jay McTighe of the Maryland State Department of Education; and Glen Robinson, then President of the Educational Research Service.

After carefully reviewing the qualifications of many scholars who have contributed to research in the several fields represented in the *Handbook,* the editor extended invitations to ten persons to prepare chapters in their disciplines. A clear expression of the need for such a publication and the potential contribution to the knowledge base about teaching came forth when all of the original invitees accepted the challenge. Many of them, as the brief resumés on the following page show, had previously served as senior editors of other handbooks on their subjects, and all had engaged directly in such research themselves. Thanks certainly are due to their diligence in conducting a thorough search of the literature for the best research from which to articulate a limited number of practices shown by research to have the most promise for improving student achievement. Each author contributed an extensive reference section, which readers of the *Handbook* are invited to use for further study.

Thanks are also due to Glen Robinson, former President of the Educational Research Service, who was highly supportive of this project from its inception, and to the current ERS President, John Forsyth, who has continued this support. Other ERS staff members who have contributed substantially to the project include Research Director Nancy Protheroe and Publications Coordinator Deborah Perkins-Gough, who have spent many hours reviewing manuscripts and working with the authors in preparing for publication. Katherine Behrens, ERS Coordinator of Membership and Marketing, has also helped enormously in developing plans for wide distribution of this publication.

The support of members of the Alliance for Curriculum Reform, and especially the 1995 Chairperson, Denise McKeon, has been extremely important in seeing this project to completion. The Alliance is committed to providing leadership in implementing voluntary national curriculum standards, and thus the *Handbook* makes an important contribution to the pedagogical aspects of actually ensuring that U.S. students reach high levels of achievement on these important standards.

Gordon Cawelti
Editor and Project Director

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Gordon Cawelti is Research Associate for the Alliance for Curriculum Reform, and was Executive Director of the Association for Supervision and Curriculum Development from 1973-1992. Prior to that, he served as Superintendent of the Tulsa Public Schools, as Executive Director of the North Central Association in Chicago, and as a high school principal and teacher in Iowa. He has authored some 150 articles and books on curriculum, and has carried out national studies of school innovation and restructuring. He is currently investigating the effects of school restructuring on student achievement and other outcomes. He received his Ph.D. from the University of Iowa.

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Herbert J. Walberg, *Generic Practices*

Herbert J. Walberg is Research Professor of Education at the University of Illinois at Chicago and formerly served as Assistant Professor at Harvard University. He has written and edited more than 50 books and contributed more than 380 articles to educational and psychological research journals on the topics of educational productivity and related subjects. He served as Chairman of the Technical Committee on International Education Indicators for the Paris-based Organization for Economic Cooperation and Development, and was a founding member and Chairman of the Design and Analysis Committee of the National Assessment Governing Board. He received his Ph.D. from the University of Chicago.

Chapter 1. Introduction: Using the Knowledge Base to Improve Student Achievement

Gordon Cawelti

The *Handbook of Research on Improving Student Achievement* is designed to identify classroom practices that research has shown to result in higher student achievement. The fundamental idea behind the *Handbook* is that, in order to succeed, efforts to improve instruction must focus on the existing knowledge base about effective teaching and learning.

In addition, the *Handbook* provides an important but previously missing piece in the literature, by including in one volume research related to all major disciplines currently taught in elementary and secondary schools. By bringing together what is known about effective instruction across disciplines, the *Handbook* is intended to encourage readers to learn about, discuss, and try promising approaches from other subject areas.

New Focus for Instructional Reform

Although there is a continuing controversy over whether American students have gained or lost ground academically over the last 10 or 20 years (Mullis et al. 1994, 2-3; Doyle, Cooper, and Trachtman 1991, 2), there is consensus on one issue: To succeed in the 21st century, our students must do more than master basic skills; they must also be able to analyze and understand information, to solve problems, to adapt to fast-paced change, and to learn new skills throughout their lives.

In support of the desire to provide a world-class and forward-looking education for our students, an unprecedented level of reform activity has taken place at both the federal and state levels in the past decade. However, the most recent data do not indicate major improvements in student achievement. One lesson comes through clearly: Improved teaching—the key to improved student learning—cannot be mandated by "top-down" reforms.

Thus, the focus of reform is now shifting to the school and classroom level. Many school districts are following industry trends by placing responsibility for improvement directly with those who deliver the goods or services. Genuine participation of those closest to the needs of students, the teachers and principals in individual schools, is being encouraged as part of the planning process for school improvement. The hope is that this process will result both in better plans and in commitment by staff to devote the time and energy needed to put these plans into practice. The *Handbook of Research on Improving Student Achievement* was specifically designed to help school administrators and teachers carry out their instructional leadership roles, by giving them a ready source of authoritative,

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The preparation of the *Handbook of Research on Improving Student Achievement* was made possible through the financial support of the Rockefeller Foundation. The primary sponsor of the *Handbook* is the Alliance for Curriculum Reform (ACR), an organization of 30 major professional subject-matter organizations whose primary interests are in the implementation of voluntary national curriculum standards. (See the back of the publication for a more detailed description and a listing of ACR members.) The *Handbook* publisher, Educational Research Service (ERS), is the premier agency for providing research and information to the nation's public schools. ERS staff and information resources contributed to the preparation of the *Handbook*.

yet practitioner-based information about research on effective teaching and learning.

Developing the *Handbook*

The scholars selected to prepare the sections of this *Handbook* have all had extensive research experience in their particular fields, as their biographies indicate. As a group, they have the particular expertise needed to judge the quality of research, to conduct the extensive searches that were required, and to prepare the syntheses appearing in this *Handbook*. Perhaps most importantly, they are relatively free of bias, unlike some scholars who are also strong advocates of particular approaches in their own fields.

The format selected for the *Handbook* is designed to make clear both the nature of the selected practices and the kind of achievement promoted by each one. For each practice identified as being research-based, only the most important studies that support such a finding are included. The lists of references following each section were included to encourage persons using this *Handbook* to obtain complete texts of the research used if they wish to more fully study and understand the practice.

Considerable discussion was held about what practices to include in each of the sections of the *Handbook*. However, the editor made no attempt to prescribe the number, size, or duration of studies required to include a particular practice; this was left to the judgment of each author. The research cited to support specific practices includes collections of experimental studies, correlational or relational studies, meta-analyses, best-evidence syntheses, and other reviews of the research literature.

The authors agreed that they wanted to include classroom practices recognized in the new educational standards that are just emerging and for which no substantive research yet exists. Thus, in some instances a particular practice is included mainly because of the scholar's judgment that it reflects a serious attempt to promote "higher-order thinking skills" or to help students make more personal connections with what they learn. Those who use this *Handbook* will see a mixture of emerging strategies and practices in long-term use.

Another decision made in preparing the *Handbook* was to avoid creating separate sections for practices aimed at students who might be categorized as "at-risk"—for example, those from poor socioeconomic backgrounds, racial minorities, and those for whom English is a second language. We recognize that many schools have an urgent need to develop plans directed toward significantly improving the achievement of these students. However, in a thorough analysis of programs designed specifically for at-risk children at the pre-school and elementary level and for special education students, Slavin, Karweit, and Madden (1989) stress that the qualities of effective teachers for disadvantaged students in these programs tended to be similar to the qualities of effective teachers for all students. And the most intensive classroom observational study of effective teaching practices relating to "at-risk" children conducted in recent years, titled *Academic Challenge for the Children of Poverty* and financed by the U.S. Department of Education, found that:

> The results present clear evidence that alternative [teaching] practices work at least as well for low-performing as high-performing students. In all three subject areas [mathematics, reading, and writing], instruction aimed at meaning and understanding appeared to work as well for students at the low end as those at the high end of the achievement distribution (Knapp, Shields, and Turnbull 1992, 27).

The definition of achievement used in the *Handbook* is clearly a very critical issue. While much of the scholarly research over the years has relied on standardized test results in cognitive areas of knowledge and skills, this is not the only outcome expected of schools. If a particular classroom practice in science, for example, results in students liking science better and taking more classes, that is also an important achievement. If certain approaches enable students to understand and value diversity in people, that is an important achievement. A goal of a school district might be to raise minority students' academic performance, but an equally important type of achievement would be to increase minority students' access to social networks and institutions of higher education.

In short, the authors were encouraged to use a broad definition of achievement as they identified research-based practices that lead to improved achievement in concepts, values, or skills. Even so, the preponderance of studies reported rely on more traditional kinds of testing of knowledge and skills. This is not to say that other kinds of achievement are not important, but rather that less research has been done in associating classroom practices with the highly important kinds of non-traditional achievement measures just described.

A final issue during the preparation of the *Handbook* involved the decision to present these effective practices by subject area. Representatives of the member organizations of the Alliance for Curriculum Reform are fully aware of the need to develop interdisciplinary approaches to organizing the curriculum if students are to make connections between ideas and knowledge in different subject fields. In addition, it has become increasingly apparent that the newly emerging voluntary curriculum standards stand little chance of being implemented through a separate-subjects curriculum, because of the large body of knowledge they represent and the limited time available in a given school day.

The key elements of the current educational system, such as teacher training, schedules, textbooks, and assessment, tend to be discipline-based. Despite this, teachers themselves have increasingly come to recognize that students need to be helped to see the relationships among important concepts, and have forged ahead in developing more interdisciplinary approaches, or what has come to be called an integrated curriculum. Elementary teachers have a natural setting for such instruction in their self-contained classrooms. At the secondary level, the organization and schedule changes required for such curriculum integration have made the practice less prevalent, yet significant numbers of high schools are changing to block schedules, teaming arrangements, and interdisciplinary teaching (Cawelti 1994, 8-17).

However, while there is much advocacy of curriculum integration, its very nature has tended to limit reliable research on its efficacy, and the vast body of research on effective instructional practices has typically been reported by broad subject fields. According to Goodlad and Zhizin, "almost all the literature on curriculum organization is conceptual or prescriptive and rarely experimental" (1992, 339). Carefully conceived longitudinal research on the effects of curriculum integration is needed, and no doubt will be forthcoming.

Whatever research has been done on integrated approaches within the disciplines is included in this *Handbook* if judged to be appropriate. Although these chapters are arranged by broad subject fields, readers will note many commonalities between the research-based practices identified by the scholars in different subject fields.

Using the *Handbook*

The *Handbook of Research on Improving Student Achievement* provides a synthesis of the knowledge base that exists about effective practices for improving teaching and learning. It is intended for use by teachers, principals, other instructional leaders, and policy makers who are undertaking the quest to attain world class standards while meeting the needs of an increasingly diverse student body.

The research findings presented in the *Handbook* should be viewed as reliable information to be used as a starting point in developing comprehensive school improvement plans, rather than as a prescription that is equally applicable to all classrooms. In her chapter on foreign language, Myriam Met makes this point clearly:

> Research cannot and does not identify the right or best way to teach, nor does it suggest that certain instructional practices should always or should never be used. But research *can* illuminate which instructional practices are most likely to achieve desired results, with which kinds of learners, and under what conditions.

Teachers and school leaders will inevitably need time for further study, discussion, and other exposure to what a particular practice entails before deciding to include it in their school's plans. In the past, a number of policies have attempted to mandate what someone believed were the universal features of effective teaching in all classrooms, with discouraging results. The importance of variations among schools' traditions and cultures should not be underestimated.

The complexities involved in putting the knowledge base on improving student achievement to work in classrooms must be recognized. Dennis Sparks, in his chapter on staff development, clearly articulates the responsibility of schools and school districts to establish a culture in which teachers can exercise their professional competence, explore promising practices, and share information among themselves, while keeping the focus on the ultimate goal of staff development—the improvement of student learning. Considerable research has been done to ascertain the effects on student achievement when attention is paid to creating a school culture or workplace that seeks to enhance teacher efficacy, wherein teachers actually believe they have the ability to influence how well students learn (Guskey and Passaro 1994).

Within such a culture, much of the best staff development goes on teacher-to-teacher every day. Teachers in all subject areas and at all grade levels will find information throughout this *Handbook* that will relate to their own experience, not only in the section on generic practices, but also in the practices in each subject area. Thus, the *Handbook* gives teachers the opportunity to discuss what their own professional experiences in their subject field or grade level bring to the profession as a whole. Through such discussions, an important goal of the *Handbook* project will be served—to ensure that the adoption of effective instructional practices is not limited by barriers between subject areas.

An example of a teaching practice that can also be used in other subject areas is the Learning Cycle Approach described by Dorothy Gabel in her chapter on science, which can also be used in other disciplines. This three-phase method of engaging students in exploration, invention, and application has been shown to result in better content achievement, improved thinking skills, and more positive student attitudes. As another example, James Shaver in his chapter on social studies cites support for Concept Development as an important instructional practice and outlines specific methods of improving students' skills in this area; this approach also has wide applicability in other content areas.

In considering the instructional practices discussed in the *Handbook*, readers should be aware that, in most cases, the results of research on specific teaching practices show only small or moderate gains. In education, we need to understand, carefully select, and use combinations of teaching practices that together increase the *probability* of helping students learn, knowing that these practices may not work in all classrooms at all times.

The strongest probability of improving student learning will emerge where schools are able to implement multiple changes in the teaching and learning activities affecting the daily life of students. For example, if the aim is to improve the quality of student composition skills in the eighth grade, the school might plan to introduce training for teachers in: 1) tutoring, 2) instruction in writing as a process, and 3) appropriate assessment techniques. The research summarized in this *Handbook* supports the efficacy of each of these instructional practices in improving students' writing achievement. To simultaneously plan for the training and other provisions needed to sustain all three of these changes would be no small undertaking, but would hold great promise for improving the quality of student compositions. Similar examples could be provided in all the major subject fields by reviewing the synthesis of research provided here within the disciplines and in the chapter on generic practices.

Even if this knowledge base is competently synthesized, comprehensible, and readily available, will teachers use it? There is a vast literature base on this topic, with disparate points of view emerging.

Louis and Dentler (1988) conducted a study of the extent to which teachers and others actually made use of information and training they received about a variety of changes being suggested for their classrooms. They found that key factors determining whether such knowledge is used include: 1) providing individual and organizational incentives; 2) allocating time to discuss and analyze the knowledge in group settings; and 3) making certain the information provided is "usable" from the practitioner's viewpoint. They concluded that more attention must be paid to such factors rather than relying on top-down mandates. Elmore points out that "the very ideas underlying teaching for conceptual understanding are subversive to the standard organizational structure of schools" (1992, 46). One cannot expect individual teachers to learn and apply the ideas of current research on teaching by themselves; there also must be changes in overall school organization.

It can be anticipated that as schools continue the task of significantly improving student achievement by expanding the knowledge base of teachers, the need to restructure schools will become more and more important. Experience has shown that teachers need the time to absorb new information, observe and discuss new practices, and participate in the training needed to become confident with new techniques. This often means changes in traditional schedules to give teachers regular opportunities to team with their colleagues both in acquiring new skills and in providing instruction. When employees in other work settings have been provided with such opportunities to assume direct responsibility for improving the quality of services, the results have been positive. It is hoped that expanding the knowledge base and changing the culture of schools to promote such empowerment will result in higher student achievement and schools in which students, parents, and the community have a high degree of confidence.

References

Cawelti, Gordon. 1994. *High School Restructuring: A National Study*. Arlington, VA: Educational Research Service.

Doyle, Dennis P., Bruce S. Cooper, and Roberta Trachtman. 1991. *Taking Charge: State Action on School Reform in the 1980s*. Indianapolis, IN: Hudson Institute.

Elmore, Richard F. 1992. "Why Restructuring Alone Won't Improve Teaching." *Educational Leadership* Vol. 49, No. 7: 44-48.

Goodlad, John I. and Su Zhizin. 1992. "Organization of the Curriculum." In *Handbook of Research on Curriculum*, Philip Jackson, editor. New York: Macmillan Publishing Company.

Guskey, Thomas R. and Perry D. Passaro. 1994. "Teacher Efficacy: A Study of Construct Dimensions." *American Educational Research Journal* Vol. 31 (Fall 1994): 627-643.

Knapp, Michael, Patrick Shields, and Brenda Turnbull. 1992. *Academic Challenge for the Children of Poverty: The Summary Report*. Washington, DC: U.S. Department of Education, Office of Policy and Planning. [Reprinted from original by Educational Research Service, Arlington, Virginia.]

Louis, Karen Seashore and Robert A. Dentler. 1988. "Knowledge Use and School Improvement." *Curriculum Inquiry* Vol. 18, No. 1: 34-61.

Mullis, Ina V.S. et al. 1994. *NAEP 1992 Trends in Academic Progress*. Washington: National Center for Education Statistics.

Slavin, Robert E., Nancy L. Karweit, and Nancy A. Madden. 1989. *Effective Programs for Students at Risk*. Boston: Allyn and Bacon.

Chapter 2. Generic Practices

Herbert J. Walberg

The practices in this section are general in that they can be applied widely to the academic subject matter of kindergarten through twelfth grade. They show powerful and consistent effects for students in widely varying circumstances. As with all educational practices, of course, they can be effectively or ineffectively planned and conducted, and the results will vary accordingly.

The research on these practices has accumulated over half a century. Several of the major references used are studies conducted by my colleagues and myself, funded by grants from the National Institute of Education and the National Science Foundation. These studies compiled the results of research summaries and synthesized several hundred investigations of educational practices by many scholars. The practices were further investigated by analyzing large national achievement surveys of U.S. elementary and secondary students. Information from European countries and Japan was also analyzed to shed light on why students in these countries often do better than American students on achievement tests.

Most of the research employed standardized achievement test scores as learning criteria, rather than measures of "higher-order processes" such as critical thinking as revealed on essay examinations. Research usually shows that students must know the facts of the subject as a prerequisite to understanding it and demonstrating mastery of the higher processes. It would be astonishing to find a student who could explain the causes of wars in American history but who had little knowledge of basic facts such as presidents or important dates. Nor can students play musical instruments well without knowing the scales and elementary musical theory. Nor is it easy to learn mathematical division before addition and subtraction, or calculus before algebra.

Some authorities, nonetheless, believe that conventional tests do not measure all that is valuable to learn in their fields, including attitudes, values, and special skills. Many science specialists, for example, believe that scientific insights, skeptical attitudes, and strong interests are supported by laboratory experiences, even though it is difficult to observe or measure such effects. Similarly, many teachers of writing believe that essays, rather than standardized tests, are the best measures of writing mastery. And knowing the musical scales and music theory hardly guarantees musical artistry.

Experiences that foster positive attitudes, values, and higher order learning are valuable in their own right even if their effects cannot be clearly shown. The teamwork seen in science laboratory work and the excitement of discovery may be considered self-justifying. Humming a classical tune on the way home after learning it in a music class may be justification enough. Surely, writing ability is a valuable skill in many aspects of life although it is difficult to measure quantitatively. Thus, assessments of these types of student achievement are a valid part of classroom teaching even though research on them is less than definitive.

The other chapters of this *Handbook* recommend more specific practices that appear particularly useful in achieving the special goals of each subject. Although the practices in this chapter can be generally recommended, they should be considered companions rather than substitutes for the particular practices of the other sections.

As mentioned above, the practices in this section are generally powerful and consistent in promoting learning. Some other practices can be cited that are nearly as good. For further reading on the practices in this section and others, the following works may be consulted: Husén and Postlethwaite 1994; Lipsey and Wilson 1993; Walberg 1984; Wang, Haertel, and Walberg 1993a, 1993b; Waxman and Walberg 1991; and Wittrock 1986.

2.1. Parent Involvement: Learning is enhanced when schools encourage parents to stimulate their children's intellectual development.

Research findings:

Dozens of studies in the U.S., Australia, Canada, England, and elsewhere show that the home environment powerfully influences what children and youth learn within and outside school. This environment is considerably more powerful than the parents' income and education in influencing what children learn in the first six years of life and during the 12 years of primary and secondary education. One major reason that parental influence is so strong is that, from infancy through age 18, children spend approximately 92 percent of their time outside school under the influence of their parents.

Cooperative efforts by parents and educators to modify these alterable academic conditions in the home have strong, beneficial effects on learning. In 29 controlled studies, 91 percent of the comparisons favored children in such programs over nonparticipant control groups.

In the classroom:

Sometimes called "the curriculum of the home," the home environment refers to informed parent-child conversations about school and everyday events; encouragement and discussion of leisure reading; monitoring and critical review of television viewing and peer activities; deferral of immediate gratification to accomplish long-term goals; expressions of affection and interest in the child's academic and other progress as a person; and perhaps, among such unremitting efforts, laughter, caprice, and serendipity. In the years before school, reading to and with the child and animated discussion of everyday events prepare children for academic activities in school.

A home-school connection that explains the benefits of these approaches and provides support for parents who wish to develop a strong academic environment for their children exerts a positive influence on student learning.

References:

Graue, Weinstein, and Walberg 1983; Iverson and Walberg 1982; Walberg 1984.

2.2. Graded Homework: Students learn more when they complete homework that is graded, commented upon, and discussed by their teachers.

Research findings:

A synthesis of more than a dozen studies of the effects of homework in various subjects showed that the assignment and completion of homework yields positive effects on academic achievement. The effects are almost tripled when teachers take time to grade the work, make corrections and specific comments on improvements that can be made, and discuss problems and remedies with individual students or the whole class.

In the classroom:

Among advanced countries, the U.S. has the least number of school days because of the long summer vacation. U.S. students also spend less time, on average, doing homework. Extending homework time is a proven way to lengthen study time and increase achievement, although the quality of the assignments and completed work are also important.

Like a three-legged stool, homework requires a teacher to assign it and provide feedback, a parent to monitor it, and a student to do it. If one leg is weak, the stool may fall down. The role of the teacher in providing feedback—in reinforcing what has been done correctly and in reteaching what has not—is key to maximizing the positive impact of homework.

Districts and schools that have well-known homework policies for daily minutes of required work are likely to reap benefits. Homework "hotlines" in which students may call in for help have proven useful. To relieve some of the workload of grading, teachers can employ procedures in which students grade their own and other students' work. In this way, they can learn cooperative social skills and how to evaluate their own and others' efforts.

References:

Paschal, Weinstein, and Walberg 1984; Walberg 1984, 1994.

2.3. Aligned Time on Task: Students who are actively focused on educational goals do best in mastering the subject matter.

Research findings:

More than 130 studies support the obvious idea that the more students study, other things being equal, the more they learn. It is one of the most consistent findings in educational research, if not all psychological and social research. Time alone, however, does not suffice. Learning activities should reflect educational goals. This alignment or coordination of means with goals can be called "curricular focus." A similar reform term is "systemic reform," which means that the three components of the curriculum—1) goals, 2) textbooks, materials, and learning activities, and 3) tests and other outcome assessments—are well matched in content and emphasis.

In the classroom:

The amount learned reflects both study time and curricular focus. Curricular focus represents efforts to decide what should be learned by a given age or grade level and then concentrating attention, time, and energy on these elements. Consequently, students at a given grade level should have greater degrees of shared knowledge and skills as prerequisites for further learning; teachers can avoid excessive review; and progress can be better assessed.

Teachers have the most direct role in ensuring that this emphasis is carried into the classroom. The teacher's skillful classroom management, by taking into account what is to be learned and identifying the most efficient ways to present it, increases effective study time. Students who are actively engaged in activities focused on specific instructional goals make more progress toward these goals.

References:

Anderson and Walberg 1994; Fredrick 1980; Fredrick and Walberg 1980; Walberg and Fredrick 1992.

2.4. Direct Teaching: Direct teaching is most effective when it exhibits key features and follows systematic steps.

Research findings:

Many studies show that direct teaching can be effective in promoting student learning. The process emphasizes systematic sequencing of lessons, a presentation of new content and skills, guided student practice, the use of feedback, and independent practice by students. The traits of teachers employing effective direct instruction include clarity, task orientation, enthusiasm, and flexibility. Effective direct teachers also clearly organize their presentations and occasionally use student ideas.

In the classroom:

The use of direct teaching can be traced to the turn of the century; it is what many citizens and parents expect to see in classrooms. Done well, it can yield consistent and substantial, although perhaps not the very best, results. Whole-class teaching of diverse groups may mean that lessons are too advanced for slower students and too repetitive for the quick. In the last decade or two, moreover, theorists have tried to transfer more control of lesson planning and completion to students themselves so that they "learn to learn," as several subsequent practices exemplify.

Six phased functions of direct teaching work well:

1) daily review, homework check, and, if necessary, re-teaching;
2) rapid presentation of new content and skills in small steps;
3) guided student practice with close teacher monitoring;
4) corrective feedback and instructional reinforcement;
5) independent practice in seatwork and homework with a high (more than 90 percent) success rate; and
6) weekly and monthly reviews.

References:

Brophy and Good 1986; Gage and Needles 1989; Wang, Haertel, and Walberg 1993a, 1993b.

2.5. Advance Organizers: Showing students the relationships between past learning and present learning increases its depth and breadth.

Research findings:

More than a dozen studies show that when teachers explain how new ideas in the current lesson relate to ideas in previous lessons and other prior learning, students can connect the old with the new, which helps them to better remember and understand. Similarly, alerting them to key points to be learned allows them to concentrate their attention on the most crucial parts of the lessons.

In the classroom:

Advance organizers help students focus on key ideas by enabling them to anticipate which points are important to learn. Understanding the sequence or continuity of subject matter development, moreover, can be motivating. If students simply learn one isolated idea after another, the subject matter may appear arbitrary. If they are given a "mental road map" of what they have accomplished, where they are presently, and where they are going, they are more likely to avoid unpleasant surprises and set realistic goals. Similar effects can be accomplished by goal setting, overviewing, pretests before lessons that sensitize students to points to learn, and pre-questions stated in textbooks and by teachers.

It may also be useful to show how what is being learned solves problems that exist in the world outside school and that students are likely to encounter in later life. For example, instruction in human biology that features nutrition and exercise applications is likely to be more interesting than abstract biology.

Teachers and textbooks can sometimes make effective use of graphic advance organizers. Maps, time tables, flow charts depicting the sequence of activities, and other such devices may be worth many hundreds of words. They may also be easier to remember.

References:

Ausubel 1968; Walker 1987; Weinert 1989.

2.6. Teaching of Learning Strategies: Delegating some control to students for the learning goals and the monitoring of personal progress in achieving them yields learning gains.

Research findings:

In the 1980s, cognitive research on teaching sought ways to encourage self-monitoring, self-teaching, or "meta-cognition" to foster achievement and independence. Skills are important, but the learner's monitoring and management of his or her own learning has primacy. This approach transfers part of the direct teaching functions of planning, allocating time, and review (see Practice 2.4) to learners. Being aware of what goes on in one's mind during learning is a critical first step to effective independent learning.

Some students have been found to lack this self-awareness and must be taught the skills necessary to monitor and regulate their own learning. Many studies have demonstrated that this can be done and that positive effects can accrue.

In the classroom:

Students with a repertoire of learning strategies can measure their own progress towards explicit goals. When students use these strategies to strengthen their opportunities for learning, they simultaneously increase their skills of self-awareness, personal control, and positive self-evaluation.

Three possible phases of teaching about learning strategies include:

1) modeling, in which the teacher exhibits the desired behavior;
2) guided practice, in which students perform with help from the teacher; and
3) application, in which students act independently of the teacher.

As an example, a successful program of "reciprocal teaching" fosters reading comprehension by having students take turns in leading dialogues on pertinent features of texts. By assuming the roles of planning and monitoring ordinarily exercised by teachers, students learn self-management. Perhaps that is why tutors learn from tutoring, and why it is said, "To learn something well, teach it."

References:

Haller, Child, and Walberg 1988; Palincsar and Brown 1984; Pearson 1985.

2.7. Tutoring: Teaching one student or a small number with the same abilities and instructional needs can be remarkably effective.

Research findings:

Because it gears instruction to needs, tutoring has yielded large learning effects in several dozen studies. It yields particularly large effects in mathematics—perhaps because of the subject's well-defined sequence and organization. If students fall behind in a fast-paced mathematics class, they may never catch up unless their particular problems are identified and remedied. This individualized assessment and follow-up process is the virtue of tutoring and other means of adaptive instruction.

In the classroom:

Peer tutoring (tutoring of slower or younger students by more advanced students) appears to work nearly as well as teacher tutoring; with sustained student practice it might be equal to teacher tutoring in some cases. Significantly, peer tutoring promotes effective learning in tutors as well as tutees. The need to organize one's thoughts to impart them intelligibly to others, to become conscious of the value of time, and to learn managerial and social skills are probably the main reasons for benefits to the tutor.

Even slower-learning students and those with disabilities can be in the position of teaching to others if they are given the extra time and practice that may be required to master a skill. This can give them a positive experience and increase their feelings of self-esteem. The success of two other practices in this section—the teaching of learning strategies and cooperative learning—is attributable to instructional features similar to those of tutoring.

References:

Cohen, Kulik, and Kulik 1982; Ehly 1980; Medway 1991.

2.8. Mastery Learning: In subject matter to be learned in a sequence, thorough mastery of each step is optimal.

Research findings:

More than 50 studies show that careful sequencing, monitoring, and control of the learning process raises the learning rate. Pre-testing helps determine what should be studied; this allows the teacher to avoid assigning material that has already been mastered or for which the student does not yet have the requisite skills. Ensuring that students achieve mastery of initial steps in the sequence helps ensure that they will make satisfactory progress in subsequent, more advanced steps. Frequent assessment of progress informs teachers and students when additional time and corrective remedies are needed.

In the classroom:

Because of its emphasis on outcomes and careful monitoring of progress, mastery learning can save learners' time. It allows more time and remediation for students who need it. It also enables faster learners to skip material they already know. In these ways, it is superior to direct instruction because it suits instruction to small groups and individuals, while direct instruction gears instruction to the average class member, making it too difficult for some and too easy for others.

Mastery learning programs require special planning, materials, and procedures. Teachers must be prepared to identify the components of instruction, develop assessment strategies so that individual students are appropriately placed in the instructional continuum, and provide reinforcement and corrective feedback—while continuously engaging students in lessons.

References:

Bloom 1988; Guskey 1990; Kulik, Kulik, and Bangert-Drowns 1990.

2.9. Cooperative Learning: Students in small, self-instructing groups can support and increase each other's learning.

Research findings:

As shown by more than 50 studies, learning proceeds more effectively than usual when exchanges among teachers and learners are frequent and specifically directed toward students' problems and interests. In whole-class instruction, only one person can speak at a time, and shy or slow-learning students may be reluctant to speak at all. When students work in groups of two to four, however, each group member can participate extensively, individual problems are more likely to become clear and to be remedied (sometimes with the teacher's assistance), and learning can accelerate.

In the classroom:

With justification, cooperative learning has become widespread in American schools. Not only can it increase academic achievement, but it has other virtues. By working in small groups, students learn teamwork, how to give and receive criticism, and how to plan, monitor, and evaluate their individual and joint activities with others.

It appears that American workplaces increasingly require such partial delegation of authority, group management, and cooperative skills. Like managers, teachers may need to become more like facilitators, consultants, and evaluators than supervisors. Nonetheless, researchers do not recommend that cooperative learning take up the whole school day; use of a variety of procedures, rather than cooperative learning alone, is considered to be most productive.

In addition, cooperative learning means more than merely assigning children to small groups. Teachers must also carefully design and prepare for the small-group setting. Students need instruction in skills necessary to operate successfully in small groups. Decisions must be made about the use of individual or group accountability. Care must be taken in establishing the mix of strengths and needs represented by students in the groups. Attention to these details will increase the likelihood that the cooperative groups will produce increased learning.

References:

Hertz-Lazarowitz and Miller 1992; Johnson and Johnson 1989.

2.10. Adaptive Education: Employing a variety of instructional techniques to adapt lessons to individual students and small groups raises achievement.

Research findings:

Adaptive instruction is an integrated diagnostic-prescriptive process that combines several preceding practices—tutoring, mastery and cooperative learning, and instruction in learning strategies—into a classroom management system that tailors instruction to individual and small-group needs. Strong and consistent achievement effects of adaptive programs have been demonstrated. The broader effects of adaptive instruction are probably underestimated, since the approach aims at diverse ends that are difficult to measure, including student autonomy, intrinsic motivation, teacher and student choice, and parental involvement.

In the classroom:

Adaptive education requires implementation steps executed by a master teacher including planning, time allocation, task delegation to aides and students, and quality control. Unlike most other practices, it is a comprehensive program for the whole school day rather than a single method that requires simple integration into one subject or into a single teacher's repertoire. Its focus on the individual student requires that barriers to learning first be diagnosed and then a plan be developed to address those needs.

A student with special needs or experiencing academic difficulties becomes the shared responsibility of a team of teachers and specialists. Such an approach to education calls for teachers to develop a broad spectrum of teaching approaches, along with a knowledge of when to use each of them most productively, and to coordinate their efforts with those of other professionals providing support to a student. Time and opportunity to do this are crucial for implementation of adaptive education.

Skillful professional management is required to integrate all aspects of the program. For example, curricular coordination means more than a plan for the teaching of subject matter skills and knowledge across grade levels as it applies to *all* students. Instead, it encompasses the relationship of that curriculum to the abilities and needs of *each* student. Consequently, central-office staff, principals, and teachers need more than the usual training to install and maintain adaptive programs.

As goals for school become more clear and uniform, it should be increasingly possible to develop and employ systemic approaches such as adaptive education.

References:

Wang 1992; Wang and Zollers 1990.

References

Anderson, L.W. and H.J. Walberg. 1994. *Time Piece: Extending and Enhancing Learning Time*. Reston, VA: National Association of Secondary School Principals.

Ausubel, D.P. 1968. *Educational Psychology: A Cognitive View*. New York: Holt, Rinehart and Winston.

Bloom, B.S. 1988. "Helping All Children Learn Well in Elementary School—and Beyond." *Principal* Vol. 67, No. 4: 12-17.

Brophy, J. and T. Good. 1986. "Teacher-Effects Results." In *Handbook of Research on Teaching*, M.C. Wittrock, editor. New York: Macmillan.

Cohen, P.A., J.A. Kulik, and C.L. Kulik. 1982. "Educational Outcomes of Tutoring: A Meta-Analysis of Findings." *American Educational Research Journal* Vol. 19, No. 2: 237-248.

Ehly, S.W. 1980. *Peer Tutoring for Individualized Instruction*. Boston, MA: Allyn and Bacon.

Fredrick, W.C. 1980. "Instructional Time." *Evaluation in Education* Vol. 4: 148-158.

Fredrick, W.C. and H.J. Walberg. 1980. "Learning as a Function of Time." *Journal of Educational Research* Vol. 73: 183-194.

Gage, N.L. and M.C. Needles. 1989. "Process-Product Research on Teaching." *Elementary School Journal* Vol. 89: 253-300.

Graue, M.E., T. Weinstein, and H.J. Walberg. 1983. "School-Based Home Reinforcement Programs: A Quantitative Synthesis." *Journal of Educational Research* Vol. 76: 351-360.

Guskey, T.R. 1990. "Cooperative Mastery Learning Strategies." *Elementary School Journal* Vol. 91, No. 1: 33-42.

Haller, E., D. Child, and H.J. Walberg. December 1988. "Can Comprehension Be Taught: A Quantitative Synthesis." *Educational Researcher* Vol. 17, No. 9: 5-8.

Hertz-Lazarowitz, R. and N. Miller (editors). 1992. *Interaction in Cooperative Groups*. New York: Cambridge University Press.

Husén, T. and T.N. Postlethwaite. 1994. *International Encyclopedia of Education (Second Edition)*. Oxford, UK: Elsevier Science.

Iverson, B.K. and H.J. Walberg. 1982. "Home Environment and Learning: A Quantitative Synthesis." *Journal of Experimental Education* Vol. 50: 144-151.

Johnson, D.W. and R. Johnson. 1989. *Cooperation and Competition: Theory and Research*. Edina, MN: Interaction Book Co.

Kulik, J.A., C.L. Kulik, and R.L. Bangert-Drowns. 1990. "Effectiveness of Mastery Learning Programs: A Meta-Analysis." *Review of Educational Research* Vol. 60, No. 2: 265-299.

Lipsey, M.W. and D.B. Wilson. December, 1993. "The Efficacy of Psychological, Educational, and Behavioral Treatment: Confirmation from Meta-Analysis." *American Psychologist* Vol. 49: 1181-1209.

Medway, F.J. 1991. "A Social Psychological Analysis of Peer Tutoring." *Journal of Developmental Education* Vol. 15, No. 1: 20-26.

Palincsar, A.M. and A. Brown. 1984. "Reciprocal Teaching of Comprehension Fostering and Comprehension Monitoring Activities." *Cognition and Instruction* Vol. 1: 117-176.

Paschal, R., T. Weinstein, and H.J. Walberg. 1984. "Effects of Homework: A Quantitative Synthesis." *Journal of Educational Research* Vol. 78: 97-104.

Pearson, D. 1985. "Reading Comprehension Instruction: Six Necessary Steps." *Reading Teacher* Vol. 38: 724-738.

Walberg, H.J. 1984. "Improving the Productivity of America's Schools." *Educational Leadership* Vol. 41, No. 8: 19-27.

Walberg, H.J. 1986. "Synthesis of Research on Teaching." In *Handbook of Research on Teaching*, M.C. Wittrock, editor. New York: Macmillan.

Walberg, H.J. 1994. "Homework." In *International Encyclopedia of Education (Second Edition)*, T. Husén and T. N. Postlethwaite, editors. Oxford, UK: Elsevier Science.

Walberg, H.J. and W.C. Fredrick. 1992. *Extending Learning Time*. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement.

Walker, C.H. 1987. "Relative Importance of Domain Knowledge." *Cognition and Instruction* Vol. 4, No. 1: 25-42.

Wang, M.C. 1992. *Adaptive Education Strategies: Building on Diversity*. Baltimore, MD: Paul H. Brookes Publishing.

Wang, M.C. and N.J. Zollers. 1990. "Adaptive Education: An Alternative Service Delivery Approach." *Remedial and Special Education* Vol. 11, No. 1: 7-21.

Wang, M.C., G.D. Haertel, and H.J. Walberg. 1993a. "Toward a Knowledge Base for School Learning." *Review of Educational Research* Vol. 63: 249-294.

Wang, M.C., G.D. Haertel, and H.J. Walberg. 1993b. "What Helps Students Learn?" *Educational Leadership* Vol. 51, No. 4: 74-79.

Waxman, H.C. and H.J. Walberg. 1991. *Effective Teaching: Current Research*. Berkeley, CA: McCutchan Publishers.

Weinert, F. 1989. "The Relation Between Education and Development." *International Journal of Educational Research* Vol. 13, No. 8: 827-948.

Wittrock, M.C. 1986. *Handbook of Research on Teaching*. New York: Macmillan.

Chapter 3. The Arts

Richard Colwell

The arts are the most versatile subjects in the school curriculum. This versatility leads to the perception by many educational leaders that the arts are not essential in and of themselves, although they may have a role to play in gifted and special education, in attaining goals in personal development, in focusing school esprit, in enhancing "academic" subjects, and in contributing to a variety of cognitive and affective domains. The arts are often considered a luxury, to be put aside when pressure to cover the "essentials" is too strong.

Deficiencies in arts education are compensated for by interested parents through private lessons and involvement in community arts experiences. Such evidence of the importance of the arts to parents and students has, in the past, not been taken as seriously by educational leaders as it would have been if it had occurred in other subjects. If a large proportion of parents felt it necessary to hire math tutors for their children, there would be serious questions about the adequacy of school mathematics offerings!

Even a definition of arts education is problematic. Music, visual arts, theatre, creative drama, dance, architecture, media, and literature constitute a common list, but it is not unusual to find state educational agencies including foreign language and the practical arts under the arts umbrella.

The voluntary national standards in the arts have addressed both the place of the arts in the curriculum and the definition of what is to be included. Under the standards, music, visual art, dance, and theatre are to be required for all students, a requirement that moves the arts into the area of liberal arts as opposed to the fine arts, a major shift in thinking within the educational community. The idea that all students should attain competency in at least four arts is revolutionary, renaissance-like in intention, and clearly implies that study of the arts adds meaning, understanding, and value to all aspects of a civilized society. This stance derives from the belief that the schools work within a cultural context and that inclusion of the arts is necessary to define our contemporary American culture.

Lacking a firm position in the education scheme, the arts have also lacked educational research. This lack exists in proportion to the prevalence of the art form in the school; there is more research in music and visual arts than there is in theatre and dance. Much of the research that does exist is in need of replication. Much has focused on use of art objects and/or artist performers as opposed to the solving of instructional questions. For instance, dance research journals contain delightful reports on dances, dancers, and descriptions of performance conditions, but almost nothing on the effects of differing instructional practices.

However, the paucity of systematic research studies does not mean that there is little knowledge about teaching toward the national standards and other objectives in arts education. Musicians, artists, actors, and dancers have been successfully taught for generations, and audiences for these artists have learned how to understand and appreciate the best the various cultures have to offer. The arts have also been used as therapy, accomplishing major objectives for special populations. What may be different if schools respond to the challenge of the new standards is that instructional programs may need to be modified to be used with a wider population and with students of differing ages.

The practices reported in this section are specific and are applicable to all grade levels; the teacher determines what degree of skill, knowledge, or perception is appropriate. Moreover, the emphasis is on interventions that begin in the lower grades, as the arts have many uses and many applications for even very young children. Students move, sing, paint, and act out events as early as preschool. The standards cannot be attained without consistent, long-term instruction.

The teaching of commonalities across the arts is not advocated here; the arts have as many commonalities with other school subjects as they do with one another. The fact that dance is usually accompanied by music and theatrical practices does not mean that the instructional objectives of dance, theatre, and music are similar or related. There are major differences that affect the difficulty of tasks and have implications for emphasis and sequence. Many of the teaching practices presented here, however, apply to several or all of the arts. In the presentation of the practices, generalizations are made where appropriate and references are listed.

Most of the practices in arts education can be conducted by the generalist classroom teacher, if that teacher is interested in the arts and believes in their importance for the children in his or her class. This seriousness of purpose is itself the essential practice, as indicated by considerable research and experience. Treating the arts seriously in teaching and learning is necessary for the acquisition of knowledge and skill; in addition it leads to expanded imagination and creativity in the art form itself, to the application of understanding from the arts to other subjects, and to a way of living. The arts are marked by attention to detail; subtleties in looking, seeing, and hearing are of supreme importance; symbols and metaphors must be understood.

The arts are not an isolated quantity; students must be competent in other subjects for the arts to be meaningful. Knowledge of Greek and Roman myths and the Bible is necessary to understand much of western theatre and visual art, and a sense of European history and culture is basic for study in music.

One of the attractions of the arts is that so much is accomplished by doing—one learns to draw by drawing, one learns to dance not only by viewing the *Nutcracker* on TV at Christmas time, but by moving and dancing by oneself and with others. The opportunity to "do" in the arts implies sufficient time to practice. The arts do not lend themselves to six weeks of exploration in middle school. There are many subjects in the applied arts—driver training, for example—where much can be accomplished in a six-week or nine-week period; the standards in the arts do not accommodate to such an instructional pattern.

Learning in the arts can occur, and does occur, with no more difficulty than learning in the other basic subjects of language arts, mathematics, and the social sciences. Talent and interest are important factors, as they are in all subjects. The teacher shares responsibility with the community for improving student interest, but the teacher assumes primary responsibility for emphasizing the importance of knowledge, skill, and experience in at least one art form.

3.1. Direct Instruction: Direct instruction, including modeling, leads not only to greater production/performance skill but also to improvement in understanding the art form.

Research findings:

Both practice and research in all four art fields—music, visual art, dance, and theatre—indicate that modeling as one form of direct instruction is most effective in attaining the standards related to performance/production. Extensive research findings of the Aesthetic Education Project at the Central Midwestern Regional Educational Laboratory (CEMREL) on non-performance objectives revealed that the more focused the instruction, the more dramatic the results.

Most research in visual arts was done in the first half of the century; most drawing research since that time has focused on racial, gender, and socioeconomic differences. Brewer and Colbert's study of seventh-grade students and Neperud's study of fifth-grade students both found that direct instruction led to a higher level of drawing skill. Sang discovered that the teacher's ability to model and the frequency of that modeling positively affected student performance level. Delzell found modeling to be important in developing musical discrimination skills.

Research shows that students who were taught performance were no better at analyzing parts of art works, but they did excel in deriving meaning because the holistic evaluation incorporated more of the historical and contextual aspects of the work of art.

In the classroom:

Students learning to create works of art benefit from direct teacher intervention and teacher modeling as distinguished from a discussion-based or lecture-based curriculum. With production objectives, teacher-centered instruction is more successful regardless of the student's learning style.

The essence of performance in the arts is the development of a wide range of skills: perceptual, aural, visual, and psychomotor—that facilitate dancing, acting, drawing, painting, working in media, and making music. Skills education is related to mastery education. Once the basic mastery level is attained, enhancement of skills is possible. Instruction by demonstration, coaching, close and direct observation, and modeling is most effective for a "trial and error" model of instruction. Correct initial skills learning is crucial; awkward and inefficient techniques obstruct and inhibit progress in performance. Avoiding mastery of negative skill performance reinforces the importance of direct instruction.

References:

Brewer and Colbert 1992; Delzell 1989; Green 1987; Grey 1983; Lagne 1970; Lansing 1981; Neperud 1966; Rosenthal 1984; Sang 1987; Thompson 1991.

3.2. Immediate Feedback: Providing immediate feedback to individuals, whether performing alone or in a group, is superior to delayed, group, or no feedback in promoting skill development in all areas of the arts.

Research findings:

Extensive research has been conducted on skill development with the same results, whether in the initial trials or during refinement: Immediate reinforcement, whether positive or negative, facilitates learning. Practicing mistakes (the beta hypothesis) to sensitize performers is not effective. Immediate correction is better for both short-term and long-term learning.

In the classroom:

On-the-spot corrections may take any format—a positive or negative comment, a demonstration of the error, the correct rendition, or both in a comparison mode. It is the timing and the individualization of the correction that are critical in performance improvement. The immediate interruption of an individual or a group performance emphasizes the importance of correcting the error(s); corrections made at the end of the performance have less impact, less specificity, and less power to focus attention. Bad performance habits form quickly and tend to have permanence.

Improvement is most dramatic in music, theatre, and dance, but the importance of immediate individual corrections is also evident in the teaching of performance practices in visual arts and media arts. Practical experience indicates that as an intervention, immediate individual correction is most difficult in music because of multiple performers on a single part and the fact that aural discrimination in these situations requires more training than does visual. Dance and theatre teachers use both the visual and aural (spoken/sung) senses, with visual arts teachers relying on an unchanging visual stimulus.

The need to reflect on the work as a whole to improve interpretive abilities in music, dance, theatre, and the visual arts—the product of focused instruction—is a different, though equally important, instructional practice.

References:

Baxter and Stauffer 1988; Bloom 1985; Brunelle and de Carufel 1982; Fitterling and Ayllon 1983; Fortin 1986; Gates and Bradshaw 1994; Sevigny 1977; Stokrocki 1988.

3.3. Interdisciplinary Learning: Teaching visual/spatial skills together with historical/technical information enables students to comprehend and respond to visual art as well as music, dance, theatre, and media.

Research findings:

Research studies indicate that the studio approach alone is not very successful in educating students to the aesthetic properties of a work of art. Two meta-analyses were conducted by the Dutch researcher Folkert Haanstra, who searched three computer bases—Dissertation Abstracts International, ERIC, and PSYCHinfo—as well as the *Index of British Studies, Art and Design Education, Dutch Bibliography of Research in Arts Education, Studies in Art Education,* and *Visual Arts Research.* He found 108 relevant titles; studies that did not meet the criteria for treatment or outcome measures or that did not provide sufficient statistical information were excluded. The relevant studies, including 30 on visual-spatial ability and 39 investigating aesthetic perception, indicated that studio education that is solely performance-based has no effect on visual-spatial ability and only a modest effect on aesthetic perception.

In the classroom:

Choosing, reflecting, and evaluating are important goals in the visual art education standards. Effective in developing abilities that contribute to these goals is a structured curriculum that stresses the ability to categorize art objects by concepts such as style, historical period, subject, and medium, and to make evaluations based on aesthetic properties rather than less relevant characteristics. Primary-age students can improve the perceptual skills that go beyond simple description. For example, mental transformations that move, expand, fold, and rotate shapes contribute to seeing and retaining a visual form within a two-dimensional plane, and thus are necessary in making aesthetic judgments of two-dimensional art works. Research reinforces the importance of planning for specific instructional objectives when selecting among the rich arts experiences available.

These findings from visual art have implications for the other arts. The development of aesthetic perceptual abilities in the arts does not automatically result from performance experiences; the teachable aspects in such development are knowledge-intensive and dependent on direct, focused learning experience, so they are also more powerful with older students than with younger ones. Such focused instruction is equally important in music, dance, theatre, and media education as well as the traditional visual arts.

References:

Allison 1986; Efland 1990; Haanstra 1994; Kannegeiter 1971; Koroscik 1982; Salome 1965.

3.4. Questioning Techniques: Specific questioning techniques lead to an understanding of art products and the process of creating them.

Research findings:

Most research on questioning techniques and their sequence has been completed in visual arts education, although dance and theatre also have employed this genre of research studies. Research has found that formulating questions that "set a direction, discover, analyze, classify, personalize, hypothesize, reorder, synthesize, evaluate" (in approximately that order) leads to understanding in the act of criticizing. Short-term studies in music, theatre, and visual arts consistently find that through use of questioning strategies, the teacher can get beyond superficialities and subject matter to the content of the art object. Questioning techniques, however, do not aid in attaining immediate results in improved arts production.

In the classroom:

Teaching students to think reflectively and objectively about the arts is an important goal. The sequence of questions identified by the research ("set a direction, discover, analyze, classify, personalize, hypothesize, reorder, synthesize, evaluate") is also effective in teaching production or creation. Variations of this sequence of questions have also been successful.

Questioning techniques are a teaching tool of good teachers in the arts. To be effective, questioning techniques must use the precise language of the discipline and focus on the construct. Giving approval to students who have only "a general idea" of the art work does not lead to understanding or transfer. One of the powerful components of the arts is that individuals must be able to talk about art using the vocabulary of context and expression.

Questioning techniques are especially useful with abstract art or with art that is potentially offensive because of its content. Questioning techniques can objectify the content and place the emphasis on the formal, technical, sensuous, and expressive dimensions of the work. Extensive experience with artists in the schools programs has revealed that pre- and post-materials (that is, preparation and evaluation) are ineffective unless they make use of insightful questions that follow a set sequence and use vocabulary related to the art being experienced. The most successful model has been a trip to an art gallery, play, or concert, preceded by careful preparation in the classroom, and making use of a docent/assistant working with small groups of students (six to eight) during the art experience. The questions asked before, during, and after the field trip and their sequence are the crucial elements.

References:

Armstrong 1986, 1993; Barrett and Rab 1990; Brewer and Colbert 1992; Cooper 1983; Diket 1991; Feldman 1983; Hamblen 1984; Saldaña 1989; Taunton 1983.

3.5. Reflecting on Learning/Non-Learning: Writing and/or reflecting about one's own (and others') performance/production experiences heightens discrimination and improves future performance.

Research findings:

Private arts teachers have long emphasized reflecting on one's own performance as a method of self evaluation. Extensive research projects in error identification in group settings were spurred by the visual art and music research in the Arts PROPEL program, the Pittsburgh schools' classroom application of a cognitive approach to arts education developed by Harvard Project Zero. Widely researched in recent years, error identification is found to be especially helpful in dance and theatre, two art forms that have not had the advantages of tape recordings and visual products.

Visual arts researchers have found writing important as a method of reflective criticism; music, dance, and theatre research indicates that writing is an effective means for teaching students to identify seminal events in an art work. Writing can also assist students to recognize performance inadequacies.

In the classroom:

Although writing about dance, theatre, music, and visual arts is not in itself an arts experience (except for script writing in theatre), it is a valuable teaching technique that makes learning a more active process when combined with performing, creating, or viewing/listening. Writing about what one has just done requires the use of artistic memory to focus not only on the events and their sequence but also on the quality, relationships, and meaning of these events.

Writing need not entail a critique; even a task that requires minimal writing can be a powerful means of focusing on expressive devices and moments. "Call charts"—which pinpoint specific spots in the musical recording or score for which students are to give written answers to specific questions—may be used as a means to make listening active rather than passive. Theatre and dance employ both memory and reproduction through videos to direct thought and attention to artistic events, and these can be used to elicit written responses, either general or specific. The writing is only a supplement to the important performance experience, and should always be subordinate to the performance itself.

References:

Alter 1995; Lavender and Oliver 1993; Stavropoulus 1992; Swinton 1989; Wilson 1986.

3.6. Individual Performance: *Individual* participatory experiences in the arts lead to better understanding and higher level skills than *group* experience.

Research findings:

The established practice in music is the private lesson; visual art also emphasizes individual production, although often conducted in a group setting. Students taught individually not only advance at their own pace but also receive direct feedback on their strengths and weaknesses. The research has investigated only young students; however, the problem of masking errors when performing in a group has been demonstrated at all ages.

In the classroom:

Performance is a crucial goal for each of the arts. Teaching practices that avoid putting students in situations where they sing, play, or otherwise perform alone contribute to lower levels of competence and to the perception that individual performance is more difficult and potentially embarrassing.

Tradition might promote the idea that learning to sing or otherwise perform in music is best conducted in a group situation where the individual receives reinforcement and cues from peers; research and practice, however, indicate that not only do individuals learn how to sing by singing alone, but the quality of the vocal performance of young children is better when a student sings by himself or herself rather than in a group. Learning to sing accurately is actually easier when done alone. The voices of others mask one's own efforts and interfere with one's ability to judge pitch, rhythm, and tonal quality as well as to think about what is desired before producing the sound. *Group* performance goals in music, dance, and theatre stress different competencies and should come later in the learning sequence.

In dance, theatre, and the visual arts, the individual is more prominent, less obscured by the group activity, and hence more readily habituated to individual exposure. The principle applies equally in all the arts; it is simply more difficult to apply in music.

References:

Goetze 1985; Seipp 1976.

3.7. Use of Creative Drama: Creating a story to be acted out by themselves and others can improve students' language arts skills, self-concept, peer relationships, and creativity.

Research findings:

Research in theatre has focused on creative drama, an area with its own distinct objectives. Students may be given a situation to portray—or even as few as two randomly selected words—and asked to improvise a few meaningful sentences or actions that are part of a story or the entire story. Research results vary in impact and power, but over 70 percent of studies in this area show that student learning can be improved significantly through creative drama as students assume roles and interact in improvisation.

Research with at-risk youth indicates that older students who become involved in acting scenes and events gain a greater understanding of language and literature in addition to finding relationships in the literature to their own lives, resulting in improved attitude toward the class and also toward school attendance.

Research with younger students has been in creative drama, not children's theatre. This improvisatory activity is most effective when guided by trained and imaginative leaders. Teachers with as few as two to four hours' professional development can help students accomplish objectives related to creativity in the arts. Research also shows that the action part of creative drama is important; the same results have not been observed with creative writing or oral interpretation.

In the classroom:

Teachers who relate creative drama to other subjects have found that students make increased cognitive gains and find more personal meaning in whatever subject is involved. The skills required to create and to involve other students in one's creation include listening skills, fluency, flexibility, and originality of language. Students learn to concentrate, to control vivid images, to make themselves believable, to give structure to the plot, and to make effective use of whatever space and props are available.

These findings apply to the goal of the other art forms in promoting creativity—for example, the student is asked to create a sculpture or painting from a few clues, to compose or improvise music based upon a short melody or motif, to create a dance based on a word or term, or to carry out similar projects in photography, architecture, and media.

References:

Burke 1980; Rosenberg 1989; Sharples 1992; Vitz 1983.

3.8. Visual and Aural Thinking: The use of visual and aural thinking improves performance, creation, and discrimination in arts education.

Research findings:

"Audition" is a word coined by researcher Edwin Gordon to better describe "tonal thinking" or the ability to think sounds before attempting to sing or play. Other investigators have pointed out the need for wide experience in hearing sounds before attempting to read musical notation. Ability to connect the sound, real or imagined, with the notation enables the learner to grasp the meaning of the symbols and thus gain musical literacy. In order to produce the correct pitch with the correct duration, a performer thinks about the characteristics of the note before producing it. As the habit of "prior thinking" becomes stronger, the time between thinking and producing is reduced. Dancers, actors, and visual artists describe or use gestures (mentally or physically) before moving, acting, or drawing.

Extensive research and practice indicate that mental and mental/physical practice without an instrument or going through the actions of dance or theatre improve performance. Edwin Gordon's more than ten years of research on mental thinking of sounds prior to production has helped focus the research results of others that confirm the importance of mental imagery of physical tasks.

In the classroom:

Teachers need to provide opportunities for students to learn and practice aural and visual thinking. Imagining what the music will sound like, imagining what one will draw, paint or sculpt, and visualizing in one's mind dance movements and theatrical gestures before one begins to sing, play, dance, act, create, view, or listen sets up the expectations against which actual performance is judged.

Tonal thinking is important in creating music, improvising, and adding harmony to familiar melodies. Tonal thinking creates listening expectations used in comprehending a musical work. Accomplished musicians and dancers practice mentally without producing a sound; Mozart's ability to hear an entire symphony prior to writing it is well established, and many architects and choreographers visualize their work in detail before setting it on paper. Visual and aural thinking are fundamental to the many uses of imagination that are valued outcomes of arts instruction.

References:

Arnheim 1969; Coffman 1987; Fiske 1993; Gordon 1988; Pinciotti 1982; Rideout 1992; Rosenberg 1987.

3.9. Sequencing for Understanding: Systematically following a sequence of activities relative to an art work enables students to learn the process of arts criticism.

Research findings:

The development of competencies in the affective domain (appreciation, attitude, values, and preferences) requires systematic and long-term instruction.

For example, Feldman, whose research in visual arts criticism is among the most extensive, used a sequence of description, formal analysis, interpretation, and evaluation. Several doctoral students of Feldman have successfully taught criticism to students of all ages. Feldman's system has been shown to help disadvantaged first graders in learning the basic concepts of art. The system has been successfully researched in music as well.

In the classroom:

The goal of the individual creating a work of art is to affect the lives of the viewer/listener. Early interpretation, out of sequence, leads to intellectual passivity, as the viewer focuses only on the subjective/responsive aspects of the experience rather than on the intellectually knowable aspects. The use of precise language in the sequence is necessary. In visual arts, for example, students are first given training in perception that includes techniques to identify shape, location, size, texture, and other critical elements. Details of a work of art are named and described, a method that is both heuristic and phenomenological. Next, form is analyzed and relationships of size, quality, singularity, and recurrence, etc., are systematically sought by the viewer. Only then is the focus turned to interpreting and evaluating.

The arts involve acting and responding, making and using, offering and accepting—dictating that precision of language and sequence is of importance. Listeners to music and viewers of theatre and dance must use their memory to make sequential mental comparisons in the process of describing, analyzing, interpreting, and evaluating. This process is aided by examining smaller segments in sequence. For example, museums arrange visual art products to facilitate comparison and contrast, using historical sequences or lines of social change to highlight elements of style, period, genre, and so forth.

To be effective, advance organizers that provide the framework should be at a more obvious level in the beginning stages of instruction: in music, students listen for dynamics, *tessitura*, or who is performing; viewers of dance identify forms and styles of choreography and roles and performers. On successive listenings/viewings and in successive years, the framework may direct attention to more subtle components such as counter melodies in music, supporting background in visual arts, or gestures in theatre or dance.

References:

Armstrong 1986; Chedester 1984; Feldman 1983; Fischer 1989; Lang and Ryba 1976; Ragans 1971; Richardson 1988; Twiggs 1970; Vallance 1995.

3.10. Use of Psychomotor Principles: Performance skill is enhanced through systematic instruction based on principles derived from the motor and psychomotor domain.

Research findings:

Physical tension is inhibiting to all activities involving bodily movement; hence, it is not surprising that research studies indicate that the physical disposition has a major impact on musical performance. Physical tension is reduced by regular rhythmic movement in one or more parts of the body. Primary-age students often cannot move to a regular pulsation; those who can tend to be higher achievers in the arts and in other subjects than are those who cannot. (Not all large-body muscles develop before small muscles; students can often clap more accurately and with a steadier pulse than they can move their bodies or walk to a steady pulse.)

Research findings differ by age and by extent of impairment due to tension. However, exercise, good posture, mental thinking, and improved skill each contribute to lessening of tension. Almost all studies found improvement when the principles of movement were taught.

In the classroom:

The formation of correct bodily habits requires time and instruction; teachers must not only provide daily reminders and systematic feedback to students who exhibit bodily tension in performance, but also use instructional devices such as videos, demonstrations, modeling, and specific (nonmusical) exercises designed to reduce body tension. For example, exercises that require students to pick up heavier objects result in reduced tension in holding musical instruments, violin bows, etc. With all physical movements, "follow-through" such as that practiced by golfers is important to avoid jerky and quick changes of motion. Musicians should be able to move all body parts—not only those required for performance—while performing, and such movements are a gauge of the degree of bodily tension present. For acting, dancing, or music performance to be relaxed and natural, instruction must include work towards making body motions relaxed and natural. Biofeedback and other mental exercises have a direct impact on the physical actions that are basic to the best artistic production. For example, stage fright is a recognized condition that can be attenuated by deep breathing and other relaxation exercises.

Interventions as short as two weeks' duration lead to observable improvements in performance. Teachers may need little more guidance than that provided by the Paul Rolland videos on violin instruction, which show how to apply a few selected principles of relaxation in appendages. Teachers cannot expect that students will develop tension-free performance without instruction.

References:

Dennis 1984; Rideout 1992; Rolland, Mutschler, and Colwell 1971; Wade 1990; Waite 1977.

3.11. Correct Body Use: Correct use of the body is necessary for achievement of acceptable standards in the performance arts.

Research findings:

Incorrect posture, identified in extensive and well-executed research through photographs, video, x-rays, and fluoroscopes, is the most frequently identified factor in preventing students from attaining performance standards in music, dance, and theatre. Breathing is affected as well as other muscles. Improper breath support affects tone production in vocal and instrumental performance, projection in theatre, and ability to move properly in dance. Research supports practical experience in concluding that posture makes a major difference.

In the classroom:

Artists must be as concerned about their bodies as athletes. Objectives in the arts that require the use of muscles depend on the correct use of these muscles. Warm-up exercises that help students in the correct use of the body and its muscles are critical in acting, singing, and dance, and very important in playing a musical instrument.

The proper use of the body can be guided by specific exercises. For example, one of the goals of elementary school music is to establish the "head tone" physically and in the student's ear. This can be done by singing from second-space A to third-space C, a range that is higher than the student's speaking voice. Chest singing is harmful; young singers should not force the muscles to match vocal styles such as gospel and rock. Standing helps facilitate proper breathing and reduces tension. Students can learn to sing incorrectly as well as correctly; correct singing may require the student to unlearn habits of poor posture and voice placement.

Dance requires similar instruction in posture, use of the muscles, warm-ups, and cool-downs. Alignment, centering, gravity, balance, breathing, and use of tension and relaxation are necessary concepts to learn and apply in practice. The basic posture for music, dance, and theatre can be simply described: head, chest, and pelvis are supported and in alignment, shoulders down and back but relaxed, body weight well distributed. Posture must be erect, balanced, and relaxed whether sitting, standing, or moving.

The teaching of correct posture is an intervention both to improve performance and to prevent bad habits that are difficult to identify and correct. The desirable habits are the same ones that contribute to good health in general, good health being one of the standards in dance education.

References:

Fitt, Sturman, and McClain-Smith 1993; Gackle 1987; Miller 1986; Minton 1981, 1989; Phillips 1992; Richmond 1994.

3.12. Improving Memory: "Chunking," or grouping by units to form pitch and rhythm patterns, leads to improved musical memory.

Research findings:

Musical memory is essential for listening, performing, creating, and understanding. Petzold's seminal six-year study in music with children ages one to six established the importance of patterns to musical memory. Walters' research on sequencing for declarative and procedural memory and Bamberger's lifetime of well-known research on developmental patterns in young students demonstrate pattern or gestalt learning.

In the classroom:

The memory of students, even those with minimal talent, can be improved by "chunking" pitches into commonly-used patterns. Patterns may be as short as two notes or as long as a complete melody. Chords and scales provide beginning structures for chunking pitches. Duration can be grouped by the meter of the piece into measures, by notes on a beat or patterns that represent styles of music; the rhythm of dances from the 17th to the present century provide an example of rhythmic chunking.

These patterns are further chunked into phrases, sequences, melodies, and counter melodies that are the building blocks of musical form. Performers and listeners must remember those building blocks in order to follow and make sense out of the musical composition. Other aids to musical memory, such as repetition and contrast, texture, voicing, and style, all depend upon chunking.

As perception is constantly used by musicians, chunking has provided a sufficient framework such that educated musicians are not affected by inexact page turning or temporary loss of the musical score. Musical memory is influenced by abilities to improvise and play by ear, which are related to chunking.

This practice also applies to other performance arts. For example, dancers learn the choreography by using music as an aid in chunking by phrases and more, as well as visualizing their own movements by units; actors can use chunking to learn the script of a play.

References:

Bamberger 1991; Cziko 1988; Feinstein 1984; Petzold 1966; Walters 1992.

3.13. Instruction in the Role of Symbols: The ability to read, interpret, and understand an art discipline's symbol system enables students to perform more fully and more independently in that art.

Research findings:

Performance of notated dance and music can be learned independently only if one can read the notation. Research studies in Great Britain and the United States, extensive and conforming to high standards, indicate that achievement of performance goals in dance is facilitated by a knowledge of dance notation, usually Laban. Children as young as age three have been taught Laban notation.

In the classroom:

The ability to read and understand what the composer, choreographer, or author intended is crucial for independent growth in performance. The better reader of words—the one who understands sentence structure and possesses a wide vocabulary—is more likely to appropriately interpret a play script; understanding notation in music and dance is similarly helpful. There exists a continuum in precision and meaning of symbol systems from words in literature and poetry to metaphors in visual arts. These symbol systems have levels of difficulty and require instruction and practice. Slavish adherence to notation/gestures may result in nonexpressive, sterile performance, but without symbols, performance would often become imitative rather than original and creative.

The purpose of arts education is to offer a key that will unlock the meaning of the metaphors and symbols of which art is made. However, the written symbols that make it possible to remember and reproduce an artistic creation will be learned more easily and more meaningfully if introduced after students have had vivid and successful experiences with the art form.

References:

Colley 1987; Dulieu 1994; Hodges 1992; Klemish 1970; Kurath 1986; Moses 1992.

3.14. Nonverbal Aids to Reading: The use of syllables and nonverbal gestures leads to the ability to read musical notation.

Research findings:

Notation systems of all cultures have marked similarities, and children create notational systems that are recognizable. Literally hundreds of research studies have investigated music reading systems: pitch, rhythm, fixed or moveable "do." The evidence shows that syllables and moveable "do" improve ability to read music. In dance, the Laban notation is helpful in teaching and standardizing a dance. Dance educator Alter indicates that Laban notation has the same result as the use of syllables in music—it gives exact words to indefinite places in space and directions for sequences. For example, Indian dance depends upon the use of syllables and rhythms.

In the classroom:

Reading the symbol system in music and dance is a two-step process: one first learns the meaning of the symbols and then learns how to use the symbols to read with understanding. In music the first step might be the use of Curwen hand signs, signs that represent the sol-fa syllables. Research and practice indicate the importance of using syllables to read the notation and produce music independently. Becoming facile with notation, whether music or dance, is of course the reason for learning to translate the symbols.

Research and practice indicate that performing music with the words or a neutral syllable does not lead to the ability to read music; learning remains at the rote level. The use of syllables is preferred to numbers, note names, and other techniques because the sounds produced are more musical and the syllable system provides for pitch alterations such as sharps and flats. Mastering a discipline's notation system facilitates transfer of learning as well as making one independent of teachers and peers to engage in performance for personal satisfaction.

References:

Alter 1995; Appelman 1967; Choksy 1988; Christy 1974; Colley 1987; Goetze 1985; Phillips 1992; Walker 1990.

3.15. Focus on the Arts as Separate Disciplines: Focused study of a particular art discipline provides greater achievement in that art than when it is integrated into the study of non-art subjects or when the arts are related to each other. However, other academic subjects can benefit from arts integration.

Research findings:

Thompson attempted to relate visual art and science. She found that when art was taught alone, enthusiasm for the course was greater, scores on the Torrance Test of Creativity were higher, and students outperformed the combined class on thinking skills, fantasy projects, and also on basic visual art skills. Walters has compiled extensive research that upholds this finding in music as well.

However, research and practice suggest that the arts can reinforce learning in other subjects. For example, LEAP (Learning through an Expanded Art Program) has been used in the classroom for 20 years. Results from this program show that art-centered learning experiences can promote reading, writing, and mathematics skills even as students react to and perform art. Other positive by-products are: improved motivation, problem-solving skills, and understanding of subject matter. A related program is RITA (Reading Improvement Through Art), which integrates reading in art classes and art concepts in reading classes. Creative drama improves reading skills, communication skills, and person-perception skills. Other outcomes include improved self-confidence, self-concept, leadership, self-esteem, moral reasoning skills, and assorted other personal characteristics.

In the classroom:

The objectives and standards of the arts themselves are not well-served by integrated or interdisciplinary approaches. The arts must be taught and learned as separate disciplines with their own sequence. Arts objectives are unique; transfer of learning is never easy; and many of the national standards in the arts are learned by doing and studying the arts themselves. Students' enthusiasm for the curriculum in a particular art is also increased when the objectives for the course are carefully focused.

Teachers in other disciplines should be aware, however, that the use of arts examples and even learning about art processes can make non-art curricular subjects not only more interesting but more real. The arts have always been a major part of life and culture; language arts, science, history, and other subjects cannot be thoroughly taught without use of examples from the arts.

References:

Backstrom 1988; Dean and Gross 1992; Gordon 1988; Hamblen 1992; Kardash and Wright 1987; Thompson 1991; Wagner 1988; Walters 1992.

3.16. Arts and Special Needs Students: Among special education students, production experience in the arts (such as singing, playing, drawing and painting, acting, and dancing) enhances motivation and self concept and improves attitude toward school.

Research findings:

Longitudinal research indicates that the arts are essential in the education of special needs students. Dance, art, theatre, and music therapy are separate disciplines created originally to provide services in hospitals and institutions catering to special populations. Use of selected principles from these arts therapy disciplines can help in modifying inappropriate social behaviors, improving attention span, reducing distractibility, improving attitude toward school and learning, and acting as stimulant and/or sedative depending on the procedure selected. For special education students, these production experiences contribute to improved self-perception and self-confidence that transfers to other school subjects and other experiences.

In the classroom:

Teachers using production experiences with special education students need to maintain the same standards but allow for more practice and slower progress; they need to minimize teacher talk and allow students to experiment and discover. Music notation in Braille is available from the Library of Congress; theatre of the deaf provides a model for meaningful experiences; and there is a wide choice of activities in visual arts to satisfy students of varied talent and background.

Arts instruction for special learners is equally successful at all age levels and works well in mixed-age and mixed-grade grouping. Students with like interests and like abilities work well together. Success or failure is often related to the specific etiology. Down Syndrome children matched for mental age with non-disabled children can be successful, especially in visual-motor tasks.

In the area of music, rhythmic tasks must be introduced in their simplest form, with few distracters, until the basic rhythmic tasks are mastered. There is less research in melodic responses with this population, but it appears that students grouped for mental age do equally well. Music and dance for the deaf has become a discipline, and deaf students can successfully master the elements if not the musicality.

Mentally and physically handicapped students require the same instructional patterns, with more attention to behavioral management needed for the mentally handicapped. Positive role models, use of pictures, graphs, physical gestures, modeling, and similar aids may need to be exaggerated. Behavior issues are often due to over-stimulation and over-enthusiasm, so motivation must be used with care.

References:

Allen 1989; Crain et al. 1983; Exiner and Kelynack 1994; Goodwin 1985; Moon 1994; Nocera 1981; Puretz 1992; Rosene 1976; Standley 1992; Vogel 1975; Wilkinson 1993.

References

Allen, B.J. 1989. *The Effect of Dance/Movement on the Self Concept of Developmentally Handicapped Fourth and Fifth Grade Students*. Unpublished doctoral dissertation. Ohio State University, Columbus.

Allison, B. 1986. *Index of British Studies in Art and Design Education*. Aldershot: Gower Publishing Group.

Alter, J. 1995. Personal correspondence based on results of pilot testing of National Assessment Measures.

Appelman, R.D. 1967. *The Science of Vocal Pedagogy: Theory and Application*. Bloomington, IN: Indiana University Press.

Armstrong, C. 1986. "Stages of Inquiry in Art: Model, Rationale, and Application to a Teacher Questioning Strategy." *Studies in Art Education* Vol. 28, No. 1: 37-48.

Armstrong, C. 1993. "Effect of Training in an Art Production Questioning Method on Teacher Questioning and Student Responses." *Studies in Art Education* Vol. 34, No. 4: 209-221.

Arnheim, Rudolf. 1969. *Visual Thinking*. Berkeley, CA: University of California Press.

Backstrom, E.L. 1988. *The Effects of Creative Dramatics on Student Behaviors and Attitudes in Literature and Language Arts*. Unpublished doctoral dissertation. University of California, Los Angeles.

Bamberger, J. 1991. *The Mind Behind the Musical Ear*. Cambridge, MA: Harvard University Press.

Barrett, T. and S. Rab. 1990. "Twelve High School Students, a Teacher, a Professor, and Robert Mapplethorpe's Photographs: Exploring Cultural Difference Through Controversial Art." *Journal of Multicultural and Cross-Cultural Research in Art Education* Vol. 8, No. 1: 4-17.

Baxter, S. and S. Stauffer. 1988. "Music Teaching: A Review of Common Practice." In *The Crane Symposium: Toward an Understanding of the Teaching and Learning of Music Performance*, C. Fowler, editor. Potsdam, NY: State University of New York.

Bloom, B. 1985. *Developing Talent in Young People*. New York: Ballantine.

Brewer, T.M. and C.B. Colbert. 1992. "The Effect of Contrasting Instructional Strategies on Seventh-Grade Students' Ceramic Vessels." *Studies in Art Education* Vol. 34, No. 1: 18-27.

Brunelle, J. and F. de Carufel. 1982. "Analyse des Feedback Émis par des Mitres de l'Enseignement de la danse Moderne." *Revue Quábécoise de l'Activité Physique* Vol. 2, No 1: 3-9.

Burke, J. 1980. *The Effect of Creative Dramatics on the Attitudes and Reading Ability of Seventh Grade Students*. Unpublished doctoral dissertation. University of Michigan, Ann Arbor.

Chedester, G. 1984. *An Art Critical Strategy Toward the Enhancement of Reading Comprehension Among Selected High School Students*. Unpublished doctoral dissertation. University of Georgia, Athens.

Choksy, L. 1988. *The Kodály Method, Second Edition*. Englewood Cliffs, NJ: Prentice Hall.

Christy, V.A. 1974. *Foundations in Singing*. Dubuque, IA: William C. Brown.

Coffman, D.D. 1987. *The Effects of Mental Practice, Physical Practice, and Aural Knowledge of Results on Improving Piano Performance*. Unpublished doctoral dissertation. University of Kansas, Lawrence.

Colley, B. 1987. "A Comparison of Syllabic Methods for Improving Rhythm Literacy." *Journal of Research in Music Education* Vol. 35: 221-235.

Cooper, J.L. 1983. *A Study of the Effects of Pre-Performance Materials on the Child's Ability to Respond to Theatrical Performance*. Unpublished doctoral dissertation. University of Georgia, Athens.

Crain, C. et al. 1983. "The Social and Physical Effects of a Ten Week Drama Program on Educable Mentally Retarded Adolescents." *Education and Training of the Mentally Retarded*. Washington, DC. American Association for Health, Physical Education, and Recreation, 301-312.

Cziko, G. 1988. "Implicit and Explicit Learning: Implications for and Applications to Music Teaching." In *The Crane Symposium: Toward an Understanding of the Teaching and Learning of Music Performance*, C. Fowler, editor (Chapter 7). Potsdam, NY: State University of New York.

Dean, J. and I. Gross. 1992. "Teaching Basic Skills Through Art and Music." *Phi Delta Kappan* Vol. 73, No. 8: 613-616.

Delzell, J. 1989. "The Effects of Musical Discrimination Training in Beginning Instrumental Music Classes." *Journal of Research in Music Education* Vol. 37, No. 1: 21-31.

Dennis, A. 1984. "The Effect of Three Methods of Supporting the Double Bass on Muscle Tension." *Journal of Research in Music Education* Vol. 32: 95-103.

Diket, M. 1991. *Art Criticisms: Relationships to Critical Thinking, Appreciation, and Creativity Among the Gifted*. Unpublished doctoral dissertation. University of Georgia, Athens.

Dulieu, J. 1994. *Language of Dance for All*. London: The Language of Dance Centre.

Efland, A. 1990. "An Approach to the Assessment of Art Learning." *Arts and Learning Research, The Journal of the Arts and Learning Special Interest Group, AERA* Vol. 8, No. 1: 50-65.

Exiner, J. and D. Kelynack. 1994. *Dance Therapy Redefined: A Body Approach to Therapeutic Dance*. Springfield, IL: C.C. Thomas.

Feinstein, H. 1984. "The Metaphoric Interpretation of Paintings: Effects of the Clustering Strategy and Relaxed Attention Exercises." *Studies in Art Education* Vol. 252: 77-83.

Feldman, E.B. 1983. "Objects and Images, Museums and Schools: Using Them to Teach." *Journal of Aesthetic Education* Vol. 17, No. 3 (Fall 1983): 39-52.

Fisher, C. 1989. *Effects of a Developmental Drama-Inquiry Process on Creative and Critical Thinking Skills in Early Adolescent Students.* Unpublished doctoral dissertation. Kansas State University, Manhattan.

Fiske, H. 1993. *Music Cognition and Aesthetic Attitudes.* Lewiston, NY: Edwin Mellen Press.

Fitt, S., J. Sturman, and S. McClain-Smith. 1993. "Effects of Pilates-based Conditioning on Strength, Alignment, and Range of Motion in University Ballet and Modern Dance Majors." *Kinesiology and Medicine for Dance* Vol. 16, No. 1 (Fall 1993-94): 36-51.

Fitterling, J. and T. Ayllon. 1983. "Behavioral Coaching in Classical Ballet: Enhancing Skill Development." *Behavior Modification* Vol. 7, No. 3: 345-368.

Fortin, S. 1986. *Characteristics of Efficient and Inefficient Feedback as Perceived by Experienced Students and Teachers in Modern Dance.* Heidelberg: AISEP World Convention Abstracts.

Gackle, M.L. 1987. *The Effect of Selected Vocal Techniques for Breath Management, Resonation, and Vowel Unification Tone Production in the Junior High School Female Voice.* Unpublished doctoral dissertation. University of Miami, Coral Gables, Florida.

Gates, A. and J.L. Bradshaw. 1994. "Effects of Auditory Feedback on a Musical Performance Task." *Perception and PsychoPhysics* Vol. 16: 105-109.

Goetze, M. 1985. *Factors Affecting Accuracy in Children's Singing.* Unpublished doctoral dissertation. University of Colorado, Boulder.

Goodwin, D.A. 1985. "An Investigation of the Efficacy of Creative Drama as a Method for Teaching Social Skills to Mentally Retarded Youth and Adults." *Youth Theater Journal* Vol. 34, No. 2: 23-26.

Gordon, E.E. 1988. *Learning Sequences in Music: Skill, Content, and Patterns.* Chicago: G.I.A.

Green, G.A. 1987. *The Effect of Vocal Modeling on Pitch Matching Accuracy of Children in Grades One Through Six.* Unpublished doctoral dissertation. Louisiana State University, Baton Rouge.

Grey, J. 1983. "The Science of Teaching the Art of Dance: A Description of a Computer-Aided System for Recording and Analyzing Dance Instructional Behaviors." *Journal of Education for Teaching* Vol. 9, No. 3: 264-279.

Haanstra, F. 1994. *Effects of Art Education on Visual-Spatial Ability and Aesthetic Perception: Two Meta Analyses.* Amsterdam, The Netherlands: Thesis Publishers.

Hamblen, K.A. 1984. "An Art Criticism Questioning Strategy Within the Framework of Bloom's Taxonomy." *Studies in Art Education* Vol. 26, No. 1: 41-50.

Hamblen, K.A. 1992. "Performing and Visual Arts Programs that Promote Literacy: Visual Arts." Washington, DC: U.S. Department of Education, Unpublished manuscript, Chapter 5.

Hodges, D. 1992. "The Acquisition of Music Reading Skills." In *Handbook of Research on Musical Teaching and Learning*, R.J. Colwell, editor (Chapter 30.). New York: Schirmer Books.

Kannegeiter, R.B. 1971. "The Effects of a Learning Program in Activity Upon the Visual Perception of Shape." *Studies in Art Education* Vol. 12, No. 2: 18-27.

Kardash, C.A. and L. Wright. 1987. "Does Creative Drama Benefit Elementary School Students? A Meta Analysis." *Youth Theatre Journal* Vol. 1, No. 3: 11-18.

Klemish, J.J. 1970. "A Comparative Study of Two Methods of Teaching Music Reading to First Grade Children." *Journal of Research in Music Education* Vol. 18: 355-364.

Koroscik, J.S. 1982. "The Effects of Prior Knowledge, Presentation Time, and Task Demands on Visual Art Processing." *Studies in Art Education* Vol. 23, No. 3: 13-22.

Kurath, G.P. 1986. *Half a Century of Dance Research.* Flagstaff, AZ: Cross Cultural Dance Research.

Lagne, W.V. 1970. *The Effects of Curricular Dramatics on Children's Acting Skill.* Unpublished doctoral dissertation. Northwestern University, Evanston, Illinois.

Lang, R.J. and K. Ryba. 1976. "The Identification of Some Creative Thinking Parameters Common to the Artistic and Musical Personality." *British Journal of Educational Psychology* Vol. 46: 267-279.

Lansing, K. 1981. "The Effect of Drawing on the Development of Mental Representation." *Studies in Art Education* Vol. 22, No. 3: 15-23.

Lavender, L. and W. Oliver. 1993. "Learning to 'See' Dance: The Role of Critical Writing in Developing Students' Aesthetic Awareness." *Impulse* Vol. 1, No. 1: 10-20.

Miller, R. 1986. *The Structure of Singing: System and Art in Vocal Technique.* New York: Schirmer Books.

Minton, S.C. 1981. *The Effects of Several Types of Teaching Cues on Postural Alignment of Beginning Modern Dancers: A Cinematographic Analysis.* Unpublished doctoral dissertation. Texas Women's University, Denton.

Minton, S.C. 1989. *Body and Self: Partners in Movement.* Champaign, IL: Human Kinetics Books.

Moon, Bruce L. 1994. *Introduction to Art Therapy: Faith in the Product.* Springfield, IL: Charles Thomas.

Moses, N. 1992. "The Effects of Movement Notation on the Performance, Cognition, and Attitudes of Beginning Ballet Students at the College Level." In *Dance: Current Selected Research Volume II*, L. Overby and J. Humphrey, editors. New York: AMS Press.

Neperud, R.W. 1966. "An Experimental Study of Visual Elements, Selected Art Instruction Methods, and Drawing Development at the Fifth Grade Level." *Studies in Art Education* Vol. 7, No. 2: 3-13.

Nocera, S.D. 1981. *A Descriptive Analysis of the Attainment of Selective Musical Learnings by Normal Children and by Educable Mentally Retarded Children Mainstreamed in Music Classes at the Second and Fifth Grade Levels.* Unpublished doctoral dissertation. University of Wisconsin, Madison.

Petzold, R.G. 1966. *Auditory Perception of Musical Sounds by Children in the First Six Grades.* Madison, WI: Cooperative Research Project, U.S. Office of Education.

Phillips, K.H. 1992. "Research on the Teaching of Singing." In *Handbook of Research on Music Teaching and Learning*, R.J. Colwell, editor (Chapter 39). New York: Schirmer Books.

Pinciotti, P.A. 1982. *A Comparative Study of Two Creative Drama Approaches on Imagery, Ability, and Dramatic Improvisation*. Unpublished doctoral dissertation. Rutgers, The State University of New Jersey, Brunswick.

Puretz, S.C. 1992. "Dance Movement Therapy: A Review and Analysis of the Literature." In *Current Selected Dance Research Vol. II*, L. Overby and J. Humphrey, editors (Chapter 10). New York: AMS Press.

Ragans, R.D. 1971. *The Effects of Instruction in a Technique of Art Criticism Upon the Responses of Elementary Students to Art Objects*. Unpublished doctoral dissertation. University of Georgia, Athens.

Richardson, C.P. 1988. *Musical Thinking as Exemplified in Musical Criticism*. Unpublished doctoral dissertation. University of Illinois, Urbana.

Richmond, P. 1994. "The Alexander Technique and Dance Training." *Impulse* Vol. 2, No. 1: 24-38.

Rideout, R.R. 1992. "The Role of Mental Presets in Skill Acquisition." In *Handbook of Research on Music Teaching and Learning*, R.J. Colwell, editor (Chapter 31). New York: Schirmer Books.

Rolland, P., M. Mutschler, and R. Colwell. 1971. *Development and Trial of a Two Year Program of String Education*. Washington, DC: U.S. Office of Education, Project 5-1182.

Rosene, P.E. 1976. *A Field Study of Wind Instrument Training for Educable Mentally Handicapped Children*. Unpublished doctoral dissertation. University of Illinois, Urbana.

Rosenberg, H. 1989. "Transformations Described: How 23 Young People Think About and Experience Creative Drama." *Youth Theatre Journal* Vol. 4, No. 1: 21-27.

Rosenberg, H. with P. Pinciotti, et al. 1987. *Mental Imagery with Theatre, Creative Drama, and Imagination: Transforming Ideas into Action*. New York: Holt Rinehart.

Rosenthal, R.K. 1984. "The Relative Effects of Guided Model, Model Only, Guide Only, and Practice Only Treatments on the Accuracy of Advanced Instrumentalists' Musical Performance." *Journal of Research in Music Education* Vol. 32: 265-273.

Rowe, P.A. 1967. "Research in Dance in Colleges and Universities in the U.S.: 1901-1967." *Dance Research Annual I*, Richard Bull, editor (pp. 3-13). NY: Congress of Research on Dance.

Saldaña, J. 1989. "A Quantitative Analysis of Children's Responses to Theatre from Probing Questions: A Pilot Study." *Youth Theatre Journal* Vol. 3, No. 4: 7-17.

Saldaña, J. 1995. "Is Theatre Necessary? Final Exit Interviews with Sixth Grade Participants from the ASU Longitudinal Study." *Youth Theatre Journal*, in press.

Salome, R.A. 1965. "The Effects of Perceptual Training Upon the Two Dimensional Drawings of Children." *Studies in Art Education* Vol. 7, No. 1: 18-33.

Sang, R.C. 1987. "A Study of the Relationship Between Instrumental Music Teachers' Modeling Skills and Pupil Performance Behaviors." *Bulletin of the Council for Research in Music Education* Vol. 91: 155-159.

Seipp, N.F. 1976. *A Comparison of Class and Private Music Instruction*. Unpublished doctoral dissertation. University of West Virginia, Morgantown.

Sevigny, M. 1977. *A Descriptive Study of Instructional Interaction and Performance Appraisal in a University Studio Art Setting: A Multiple Perspective*. Unpublished doctoral dissertation. Ohio State University, Columbus.

Sharples, Gloria. 1992. *Intrinsic Motivation and Social Constraint: A Meta Analysis of Experimental Research Utilizing Creative Activities*. Unpublished doctoral dissertation. University of Oregon, Eugene.

Standley, J. 1992. "Meta Analysis of Research in Music and Medical Treatment: Effect Size as a Basis for Comparison Across Multiple Dependent and Independent Variables." In *Music Medicine*, R. Spintge and R. Droh, editors (pp. 364-378). St. Louis, MO: MMB Music.

Stavropoulus, C. 1992. *A Diagnostic Profile of Art Understandings Based on Verbal Responses to Works of Art*. Unpublished doctoral dissertation. Ohio State University, Columbus.

Stokrocki, M. 1988. "Teaching Preadolescents During a Nine-Week Sequence: The Negotiator's Approach." *Studies in Art Education* Vol. 30, No. 1: 39-46.

Swinton, S. 1989. "Assessment of Production, Perception, and Reflection in Beginning Music Portfolios." *The Newsletter of Arts Propel*. Princeton, NJ: Educational Testing Service.

Taunton, M. 1983. "Questioning Strategies to Encourage Young Children to Talk About Art." *Art Education* Vol. 36, No. 4: 40-43.

Thompson, K. 1991. *Assessing the Creative Effectiveness of Two Approaches to Teaching Art at the Middle School Level*. Unpublished doctoral dissertation. University of Georgia, Athens.

Twiggs, L.F. 1970. *The Effects of Teaching a Method of Art Criticism on the Aesthetic Responses of Culturally Disadvantaged Junior High School Students*. Unpublished doctoral dissertation. University of Georgia, Athens.

Vallance, E. 1995. "The Public Curriculum of Orderly Images." *Educational Researcher* Vol. 24, No. 2: 4-13.

Vitz, K. 1983. "A Review of Empirical Research in Drama and Language." *The Children's Theatre Review* Vol. 32, No. 4: 17-25.

Vogel, M.R. 1975. *The Effect of a Program of Creative Dramatics on Young Children With Specific Learning Disabilities*. Unpublished doctoral dissertation. Fordham University, New York.

Wade, M. 1990. "Motor Skills and the Making of Music." In *Music and Child Development: Proceedings of the 1987 Denver Conference*, F. Wilson and F. Roehmann, editors (pp. 157-178). St. Louis, MO: MMB Music.

Wagner, B.J. 1988. "Research Currents: Does Classroom Drama Affect the Arts of Language?" *Language Arts* Vol. 65, No. 1: 46-55.

Waite, J.R. 1977. *Reducing Music Performance Anxiety: A Review of the Literature and a Self Help Manual.* Unpublished doctoral dissertation. University of Oregon, Eugene.

Walker, R. 1990. *Musical Beliefs: Psychoacoustic, Mythical and Educational Perspectives.* New York: Teachers College Press.

Walters, D. 1992. "Sequencing for Efficient Learning." In *Handbook of Research on Music Teaching and Learning,* R. Colwell, editor. (Chapter 36.) New York: Schirmer Books.

Wilkinson, J., editor. 1993. *Guided Symbolic Dramatic Play as the Missing Link to the Symbolic Dramatic Play Literacy Connections, Whole Brain, Whole Body, Holistic Learning.* Needham Heights, MA: Ginn.

Wilson, B. 1986. "Art Criticism as Writing as Well as Talking." In *Research Readings for Discipline Based Art Education: A Journey Beyond Creating,* M. Dobbs, editor. Reston, Virginia: National Art Education Association.

Chapter 4. Foreign Language

Myriam Met

Every day, foreign language teachers make important instructional decisions as they plan and implement lessons. Research can make a significant contribution in informing these decisions, so that daily instruction reflects the best of what is known about foreign language teaching and learning. Research cannot and does not identify the right or best way to teach, nor does it suggest that certain instructional practices should always or should never be used. But research *can* illuminate which instructional practices are most likely to achieve desired results, with which kinds of learners, and under which conditions. Foreign language professionals know more today than ever about how learners acquire new languages and about the conditions under which language acquisition is most likely to occur.

The prevailing view among foreign language educators today is that the goal of instruction is to prepare students to function effectively in the real-life situations they are likely to encounter. This view, most frequently associated with the terms "proficiency-oriented instruction" or "communicative language teaching," has had a substantial impact on foreign language teaching practices in the last decade. The research base for communicative language instructional practices is both direct and indirect. Some evidence directly supports practices associated with the communicative approach; other practices may be inferred from the research on cognition and information processing. While some of the evidence to support emerging approaches may be indirect or limited, it should also be noted that there is a scant body of research to support past approaches to foreign language teaching, particularly the grammar-based approach.

Current constructivist theories of learning are consistent with the communicative approach to foreign language teaching and learning. As a result, foreign language educators share many beliefs about good instruction with those in other disciplines:

- Learners must be actively engaged in constructing their own understandings and knowledge.
- New knowledge builds on previous knowledge, and the learner's background knowledge plays a significant role in the construction of meaning.
- Classroom tasks should closely parallel the real-life tasks to which students may expect to apply their knowledge and skills.
- Real-life tasks are meaningful, purposeful, and rooted in context.
- Approaches to assessment should reflect the complexity of integrating knowledge and skills into performance.

Some cautions about interpreting the research reported in this chapter and its implications for classrooms are in order. The research base in foreign language education, particularly in secondary schools, is not extensive. Educators and pedagogical theoreticians are, therefore, forced to rely on studies drawn from English as a Second Language (ESL) settings, on research conducted primarily with postsecondary learners, or on research based on short-term studies. In addition, implications for foreign language instruction are occasionally extrapolated from research in first-language development, particularly in the area of reading and writing skills development. Keeping these limitations in mind when interpreting the research, it appears that learners benefit from:

- extensive exposure to meaningful, understandable language in use;
- opportunities to use the target language to interact with others, to understand others, and to make oneself understood;

- opportunities to use the target language in tasks that reflect real-life purposes and require the exchange of meaning;
- culture instruction that links cultural information, skills in observation and analysis, and ways to make meaning in a socioculturally appropriate manner;
- explicit instruction in strategies that facilitate making meaning when reading or listening to the foreign language; and
- the use of certain technological resources to assist in language learning and practice.

There are a number of areas of interest to foreign language educators where research is equivocal or minimal. Research is equivocal on the role of explicit grammar instruction and on the benefits of error correction. Further research evidence is needed that elucidates:

- the variables that affect the ways in which technology can enhance language learning, particularly in the area of distance learning;
- effective ways to teach culture, teach cross-cultural communication, and reduce ethnocentrism;
- the relationship between length and frequency of class meetings (i.e., spaced practice) and language attrition/loss, a question of particular interest to those considering block scheduling; and
- the development of reading and writing skills in secondary language learners.

While research may provide direction in many areas, it provides few clear-cut answers in most. Teachers continue to be faced daily with critical decisions about how best to achieve the instructional goals embedded in professional or voluntary state or national standards. A combination of research-suggested instructional practices and professional judgment and experience is most likely to produce students who can fill the need for a language-competent America.

4.1. Comprehensible Input: Extensive access to comprehensible input is required for acquisition of the target language.

Research findings:

Most researchers and classroom practitioners today acknowledge the critical role that comprehension plays in language acquisition. Comprehensible input is a term coined by Krashen to describe language (oral or written) that is understandable. For language growth to occur, Krashen posits that input must not only be understandable, but must also contain language that is just beyond the learner's current capacity. Some researchers also point out that salient features of the input must be "noticed" by the learner in order for "intake" to occur. That is, merely understanding the message may be insufficient; learners must also take note of the way the message is conveyed. Language development proceeds, then, from understanding what is heard (comprehensible input); noticing salient features in the input (intake), particularly those that are not yet part of the learner's repertoire; and internalizing language features that eventually become part of the learner's production.

Studies of students in immersion programs (programs in which the language is the medium of instruction for at least half of the school day) show that students develop high levels of language proficiency. Comprehensible input is accepted by most researchers as a necessary condition for successful language acquisition.

In the classroom:

The learners' need for comprehensible input suggests that teachers should use the target language extensively. Use of English decreases opportunities for comprehensible input and intake; conversely, extensive use of the target language provides an important source of input.

Teachers' language must be understandable to the learner, with multiple clues to meaning. These may include visuals, body language, and context clues to promote student understanding. In addition, comprehensible input and subsequent intake can be facilitated through use of readings that are understandable to students because of students' prior knowledge, visual cues, and context cues within the text itself. For example, reading an advertisement in a foreign language can be facilitated by knowledge of the text type (how advertisements are structured and where information can be found), prior knowledge of the advertised service or product, linguistic cues (recognizing word families or cognates), or visuals. Listening to and following commands and listening to books on tape while reading the print versions are also effective means of developing language skills.

References:

Asher 1984; Ellis 1990, 1993; Krashen 1982; Larsen-Freeman and Long 1991; Lightbown 1992.

4.2. Opportunities for Interaction: Frequent opportunities for interaction in the language, especially with their peers, help students develop oral language proficiency.

Research findings:

A number of studies have examined interaction in the classroom. These studies have shown that tasks in which students need to negotiate meaning (that is, make themselves understood and work to understand others) contribute to language growth. Further, student-to-student interaction may require more negotiation of meaning than teacher-student interaction. Teachers all too often are able to understand student utterances regardless of how poorly formed and communicated, while classmates may be less capable of deciphering their peers' mangled messages, increasing the need for students to work on understanding and being understood.

Tasks that depend on a meaningful exchange of information among students generate more negotiation of meaning than those in which information exchange is not required. Research has also shown that students working in pairs or groups do not produce more errors than in teacher-conducted instruction, that students can successfully correct one another, and that students do not learn one another's mistakes.

While research supports the importance of comprehensible input as a necessary condition for language development, research also suggests that input by itself is insufficient for the development of the ability to speak or write another language. The "comprehensible output" hypothesis holds that the need to express one's meanings leads learners to consider the relationships between meaning and form, and to refine their language so that it is comprehensible to others.

In the classroom:

The research findings suggest that teachers should provide extensive opportunities for students to interact with one another.

Interactive tasks are most beneficial when they require students to negotiate meaning and to exchange information in order to complete the task. These tasks may involve an information gap (each student in a pair may have one part of the information needed) or an opinion gap (each student needs to find out the other's views/opinions). An information gap task may require students to negotiate purchases based on the shopping list that one of the students has and the various store advertisements the other has, in order for the pair to buy a given set of items within a fixed amount. An opinion gap task may require students to find out their partners' preferences and then compare and contrast how these preferences are similar to and/or different from their own. Pooling and exchanging needed information will promote negotiated interactions between students.

References:

Doughty and Pica 1986; Gass and Varonis 1985; Long and Porter 1985; Nunan 1991; Swain 1985.

4.3. Communicative Language Practice: When classroom language practice is set in a context and requires meaningful and purposeful language use, students are enabled to communicate in a foreign language.

Research findings:

Researchers have found that engaging in interactive communication is necessary to develop fluency and to construct an understanding of the grammatical structure of the target language.

Cognitive theory suggests that language learners need to develop *automaticity* (speed, fluency, and efficiency) of language use, and be enabled to put their knowledge of the language to use in performance. Research suggests that learners can achieve automatic control of knowledge through practice under real operating conditions. That is, classroom practice needs to parallel authentic communication to the fullest extent possible, and students need adequate opportunities to develop the procedural knowledge necessary for real-life communication.

In the classroom:

Communicative language teaching is organized around the purposes people have for communicating and the things people do when they communicate. In foreign languages, this communication-based approach has been termed "proficiency-based," "proficiency-oriented," or "communicative" instruction.

Communication is a process of collaborative meaning-making. It involves interpreting the meanings conveyed by others, expressing one's own meanings, and negotiating meanings to ensure that one understands and is understood. If the goal of language learning is communication, it follows that the classroom should provide opportunities for language practice and use that include the critical features of communication: *it is always set in a context, has a purpose, and involves interpreting and/or expressing meaning.*

Foreign language educators have proposed principles for foreign language instruction derived from the research on language learning:

- Foreign language activities should be set in a meaningful context and be meaning-driven.
- Students should have opportunities to practice using language that reflect the range of contexts they are likely to encounter and the functions (tasks) they may need to carry out outside the classroom.
- Students should be encouraged to express their own meanings.
- Students need to be stretched to the limits of their language repertoire.

References:

Ellis 1990; Omaggio 1993; Savignon 1991; Shrum and Glisan 1994.

4.4. Instruction in Learning Strategies: Explicit instruction in learning strategies can help students learn languages more easily and increase student autonomy.

Research findings:

A number of studies have shown that teaching students the purpose, nature, and appropriate use of language learning strategies has long-term benefits. Explicit strategies instruction has been found to contribute to learner autonomy and enhanced language acquisition. Students who use strategies frequently and effectively are self-directed and autonomous learners who can manage their own learning with less dependence on teachers for guidance and direction.

In the classroom:

Learning strategies are mechanisms through which students engage in the process of learning and by which they can become more autonomous learners. Some learners discover and use these strategies independently without explicit knowledge of the strategy or awareness that they are using it. Researchers have investigated the strategies used by successful learners with the end goal of teaching these strategies explicitly to all students. These include:

- *Metacognitive strategies*—processes such as monitoring one's comprehension and production (checking to ensure that one understands the text as one is reading), self-assessment (evaluating the effectiveness of one's communication), and planning (brainstorming needed vocabulary and structures or outlining ideas prior to undertaking a writing task).
- *Cognitive strategies*—those used to organize information for learning (making a vocabulary web, or pairing synonymous or antonymous adjectives); to elaborate information (explaining to oneself how one aspect of cultural behavior is like another, drawing inferences about a grammar rule from given examples, or calling on prior knowledge); or to practice (rehearsing, experimenting, or imitating).
- *Social/affective strategies*—interactions such as asking peers or the teacher for assistance or clarification, collaborating with others, requesting feedback on one's communicative efforts, and self-talk to lower anxiety and urge oneself on.

Teachers can help students be more successful learners by teaching students what learning strategies are and when to use them.

References:

Chamot and Kupper 1989; O'Malley and Chamot 1993, 1990; Oxford 1990; Rubin 1981, 1995; Wenden 1991.

4.5. Instruction in Listening and Reading for Meaning: Teaching students effective ways to listen and read results in more fluent listeners and readers.

Research findings:

In addition to more general learning strategies, research has identified a number of strategies used by effective listeners and effective readers. Local strategies include using cognates and contextual clues, skipping over unknown words, and using linguistic knowledge (grammatical structures, word families). Global strategies include using background knowledge or evaluating/validating one's predictions and hypotheses. Fluent *readers* are able to predict text content and developments; they synthesize information from the text with their own background knowledge to construct an understanding of the text; and they self-monitor (check for comprehension) and self-regulate (consciously use strategies). Similarly, effective *listeners* use top-down strategies such as predicting based on background knowledge to construct meaning. They also monitor their own comprehension and they set a purpose that guides what they listen for. They synthesize their background knowledge with the context and message of what they hear. The most successful listeners use more, as well as more varied, strategies.

At lower levels of foreign language proficiency, students use fewer of the comprehension strategies that underlie successful first-language reading, and use these strategies less effectively.

In the classroom:

Teachers can improve foreign language students' ability to listen and read for meaning by providing explicit instruction in effective listening and reading strategies.

Although listening and reading differ in terms of time constraints and the opportunity to go back to parts of the message that were not understood, there are, nonetheless, great similarities in what is involved in successful listening and reading.

Models for teaching reading and listening developed by researchers include several stages:

- *Pre-reading/pre-listening activities* teach students to anticipate and predict based on background knowledge, use of advance organizers, and contextual cues. Teachers may need to supply cultural background information and establish a purpose for listening.
- *Skimming/scanning tasks* help students to locate specific information.
- *Decoding/intensive reading activities* may include guessing content or the meaning of unknown words and phrases and using connecting words to ascertain relationships within and between sentences. Decoding helps students develop rapidity by teaching them to cope with unknowns that might slow them down as they read. Intensive reading helps to identify main ideas and related supporting details.
- *Comprehension activities* include checks to see whether students have fulfilled the purpose for reading or listening, and having students summarize information or compare their interpretations with supporting evidence in the text.
- *Transfer activities* and personal reactions allow students to apply reading/listening strategies to new tasks or contexts. Students personally respond to what they have read or listened to, and compare their own perspective with that given in the oral or written materials.

Both reading and listening require an extensive vocabulary and knowledge of the structure of the language. Since foreign language readers know far fewer words than do native speakers, vocabulary development is critical to reading ability in another language. This is not to suggest, however, that pre-teaching vocabulary using lists of new words is beneficial. Rather, it is more effective to present new vocabulary in the context and topic of the text (oral or written). Teachers can use pre- and post-reading/listening activities to link vocabulary to linguistic knowledge such as word families, synonyms, and how context affects meaning.

Text organization and culture also influence the ability to interpret meaning. Certain text organizations facilitate recall (for example, cause-effect, compare-contrast). Because different cultures tend to organize texts differently, teachers can aid student comprehension by capitalizing on text organization where it is facilitative or by pointing out organizational differences when they may interfere with processing meaning.

Other research-based recommendations for teaching reading comprehension skills include: instructing students in specific strategies and extensive reading for long, concentrated periods to help students develop automaticity, increase their vocabulary and awareness of language and text structures, and develop confidence and motivation.

References:

Bacon 1992; Barnett 1986, 1995; Carrell 1984; Chamot et al. 1987; Glisan 1988, 1995; Grabe 1991; Phillips 1984; Shrum and Glisan 1994.

4.6. Writing Instruction: Effective approaches to the teaching of writing in the foreign language classroom should reflect student needs, abilities, and purposes for writing.

Research findings:

Most research on the teaching of writing has been done with students writing in their first language. Research on writing in a second language has been done primarily with English as a Second Language (ESL) learners, not with English-speaking students learning a foreign language. Of these studies, very few have been done with students below the college level or below the intermediate level of language proficiency.

Among the findings in an extensive review of the literature on teaching writing in the student's first language (L1) were: teaching grammar in isolation does not improve writing; sentence combining can contribute to improved writing; and the use of criteria/checklists for peer editing can improve writing.

A thorough review of the foreign language research related to error correction found that studies are inconclusive. The effectiveness of error correction approaches seems to vary by student cognitive style, student attitudes toward the teacher, and teacher approach to error correction. Research studies suggest that error correction may be beneficial when teachers provide a code for composition errors that students use for self-correcting and rewriting their text, or when teachers underline errors and students then rewrite. One study found that grading compositions did not affect the quantity of errors, but did result in longer compositions with more complex language.

In the classroom:

When deciding what methods to use to teach writing, teachers should consider the proficiency level of students, the purposes for writing, the intended audience, and the needs and preferences of the students.

Students of foreign languages may benefit from learning the writing strategies used by good first-language (L1) writers: they plan, pause frequently to reread what has been written and to plan what will come next, and revise. They are recursive—that is, they go back over and over again to make sure their meaning will be clear to the reader. Good writers have an awareness of their audience and bear in mind the needs of the reader. However, teachers of foreign languages should be aware that, while L1 writing research may provide some guidance for foreign language instruction, there is some question as to whether L1 writing is similar to writing in a foreign language and whether writing skills from L1 transfer. Further, the organization and style of discourse may differ between languages.

Although the effectiveness of error correction is questionable, some studies show that students want their errors corrected. Error correction may range from teacher comments without corrections, to comments with corrections embedded, to suggestions for improvement, to identification of the type of error without help, to a coding system for student self-correction, to explicit error correction. In addition, teachers may choose when to correct errors: always? only on the final product? only on early drafts? Teacher decisions may also depend on the kind of writing to be done and its purpose.

References:

Chastain 1990; Cooper 1981; Fathman and Whalley 1990; Gass and Magnan 1993; Hillocks 1986; Kaplan 1966; Krapels 1990; Krashen 1984; Lalande 1982; Omaggio 1993; Rieken 1991.

4.7. Explicit Grammar Instruction: Some types of explicit grammar instruction can improve students' grammatical competence.

Research findings:

The role of formal grammar instruction in language learning has occasioned great debate in the last decade, with research showing moderate, but not conclusive, value for explicit grammar teaching. Studies comparing students who receive grammar instruction with those who do not have shown varied results, in part because of the limitations of research designs themselves: length of the study, nature of the grammar point itself in light of each student's readiness to learn it, and method of assessment. The question of error correction is closely aligned with questions about how to develop grammatical accuracy. Reviewers of the research on error correction in foreign language instruction have found that the results are inconclusive. The studies conducted have produced contradictory evidence for the value of error correction of written work or during oral communicative activities.

In the classroom:

It is unclear whether explicit grammar instruction helps language development. The value of grammar instruction may be to highlight the structure or morphology in the input so that students gain a heightened awareness (that is, they notice the feature in the input). Over time, with sufficient exposure to comprehensible input containing the language feature, students will incorporate it into their own internalized system and produce it with ever-increasing frequency and accuracy. In contrast, grammar instruction aimed at immediate production is unlikely to be successful.

Teachers can promote language development by providing students with extensive input that includes new grammar points. Teachers may use explicit instruction combined with implicit activities to draw students' attention to significant language features. Or, tasks may require students to demonstrate their comprehension of the feature (for example, "Which word in this sentence tells whether the event took place already?").

If the purpose of grammar instruction is to enable students to notice features in the input (leading to intake), then instruction should begin with input in which the feature is deliberately embedded and in which the feature is noticeably salient (for example, a story contrasting events that took place in the past vs. events yet to take place). Teachers may then draw students' attention to the feature through a series of well-designed, meaning-focused input activities (oral and/or written) that require students to attend to the new features at the sentence and discourse level. This type of interactive, guided-induction approach can help students construct their own understanding of the grammatical principles involved.

Teachers should have realistic expectations about the ability of students to accurately produce grammar, especially while students are still gaining an understanding of a new grammar concept. Most importantly, teachers should be mindful that it takes time for students to gain control over grammar.

Teachers will need to consider a wide range of options for correcting student errors to determine which errors should be corrected, under which circumstances, and the form of correction in light of the purposes of the activity. Decisions about when and how to correct errors will depend on the purpose of the lesson, the nature of the error, and student variables. There is a range of options for correcting errors in students' oral and written production. Some theorists have argued that only certain types of errors should be corrected. For example, since discourse-level errors (such as word order) are more likely to result in miscommunication than are sentence-level errors (such as the wrong ending on the verb), the former may be more important to correct.

References:

Adair-Hauck, Donato, and Cumo 1994; Celce-Murcia 1991; Dekeyser 1993; Ellis 1993; Gass and Magnan 1993; Heilenman 1995; Larsen-Freeman and Long 1991; Mings 1993; Schmidt and Frota 1986; Van Patten 1993.

4.8. Integration of Culture: Integrating culture in language instruction improves students' ability to communicate and function in another culture.

Research findings:

Research on cross-cultural communication indicates that cultures vary in the ways in which individual factors such as sex, age, and the relationship between speakers play a role in determining how one may speak to whom. Variables inherent in the social relationships and context of communication also influence how messages determine choice of lexicon or grammatical forms. The rules governing the expressing of apologies, complaints, requests, and compliments also vary across languages.

A review of the research on the teaching of culture highlighted four factors important in preparing students for success. Teachers need to understand:

- the roles of student attitudes toward language learning in general and their willingness to learn about and understand other cultures;
- the process of acculturation: learning to see the world through the perspectives of others is a process that teachers must facilitate and support, as this process can be emotionally provocative for students;
- readiness for culture learning: since culture learning goes beyond facts to understanding of the beliefs, behaviors, and values of a culture, students must be prepared to cope with ambiguity and frustration.
- the role of self-awareness: students must understand how they are bound to their own cultural beliefs, behaviors, and values.

Research on current practices in the teaching of culture suggests that the compare-and-contrast approach to culture may lead to misperceptions. When teachers are careful to contrast cultural differences, students tend to assume that whatever has not been specifically addressed as different between cultures is, by default, the same. Similarly, using a "shared humanity" viewpoint as a point of departure in culture teaching further encourages students to assume implicit differences whenever explicit similarities are not addressed.

Research also suggests that it is unlikely that full cultural understanding can take place in the classroom, as students need the experience of being in the target culture and experiencing it. Student attitudes toward other cultures are enhanced when students have both information and direct contact with other cultures.

In the classroom:

Culture instruction focuses on developing several areas of student competence: skill in cross-cultural communication, knowledge about the civilization and daily life patterns of the target culture, and ability to observe and analyze another culture. Ultimately, language educators hope to develop positive student attitudes toward the people whose language and culture they are learning.

Culture instruction cannot and should not be separated from language instruction, because culture is the playing field on which language use takes place. Culture gives meaning to words, and different cultures may define words differently (for example, family, home, bread, work). Communicating accurately is more than using grammar and vocabulary correctly; it is ensuring that one can convey and interpret meanings accurately within the cultural context of communication. Learners may not be able to parallel native speaker usage, but research on cross-cultural communication can help make students aware of potential differences in how meanings are conveyed and sensitize them to the possibility of miscommunicating. Instruction may focus on helping students react appropriately to a variety of communicative differences, but may focus on only one or two important strategies for conveying their own meanings accurately.

Many theorists suggest that the purpose of culture instruction is not to teach facts, but rather to enable students to interpret the facts they encounter in order to increase their understanding. This problem-solving approach (as opposed to a facts-based approach) is necessary because facts are always changing; teaching facts may reinforce stereotypes rather than dispel them; and teaching facts will not, by itself, prepare students for successful encounters with the culture outside the classroom. Students also need to recognize how their own culture pervades their attitudes and beliefs, and the dangers of projecting these onto another culture.

References:

Byram and Esarte-Sarries 1991; Mantle-Bromley 1992; Olshtain 1993; Omaggio 1993; Robinson 1981.

4.9. Appropriate Assessment of Student Progress: The design and methods of student assessment should be appropriate to measure the kinds of information desired about student progress.

Research findings:

Researchers have found that assessment methods affect assessment results. For example, the extent and type of language that students produce in an oral task varies according to whether students are face-to-face with their interlocutor or speaking to a recording device. Oral production may also vary according to other testing conditions: whether the test requires spontaneous or prepared speech; whether the student speaks to the teacher, to other students, or into a recording device; and whether the task requires responses to specific questions, picture description, or is conversational in nature. Performance on reading comprehension tasks varies both by the nature of the task and the language of response—students perform differently on tasks that require constructed responses (such as open-ended questions) than on those requiring recognition and/or selection (e.g., multiple choice).

Beginning in the early 1980s, researchers began to focus on assessing students' ability to use their knowledge to communicate in real or simulated situations. To find out whether students could explain how to get from one place in town to another, researchers had students role-play giving directions. To find out whether students could listen with comprehension to gain information, researchers asked students to listen to a weather report to determine which types of activities and clothing would be appropriate on a given day. These tasks look at student performance—the ability to use knowledge and to integrate skills—rather than at knowledge or skills in isolation.

In the classroom:

Teachers assess students for diagnostic purposes as well as to ascertain the level of student learning. Teachers may find written tests of knowledge one of many useful sources of information. But these tests should be part of a broader assessment approach that looks at the student's ability to integrate knowledge in use.

Complementary assessments that provide multiple sources of evidence of student learning, including tests, should be used to measure and evaluate student progress. Oral performances, whether spontaneous or rehearsed, are important if the goal of language learning is to use language to communicate. Similarly, the ability to communicate in writing needs to be assessed through communicative writing tasks. Among the many possible sources of information about student progress are: dialogue journals; teacher-student interviews; teacher observations; student reports, exhibits, and demonstrations; student self-assessment; and portfolios of student work.

Finding out what students know and can do in their new language requires multiple sources of information and differing types of assessments. If the goal of instruction is to enable students to use the language to communicate, then tests should examine whether, indeed, students can communicate.

References:

Huebener and Jensen 1992; Phillips 1995; Shohamy 1984, 1991, 1994; Underhill 1987; Wolf 1993.

4.10. Use of Technology: Use of various forms of technology can result in improved skills in comprehending and producing a second language.

Research findings:

Because the use of technology in foreign language instruction is relatively new, the research base relating technology to language learning is not extensive. Studies have shown that use of word processors for composing in a foreign language improved student attitudes toward writing, increased accuracy in spelling and grammar, increased complexity of expression, and improved student writing. Other forms of technology have also been researched. Video-supported instruction, including use of captioned video, has been shown to improve listening comprehension. Video that allows students to call on prior knowledge and experience, and that provides visual cues to the meaning of what students hear, results in greater student learning.

One study found that individual learner characteristics such as strategy use, learning style, motivation, and gender had significant impact on the effectiveness of distance learning. Despite the proliferation of distance learning opportunities, little research is available to document its effectiveness. Many foreign language educators believe that while distance learning can contribute to language learning, by itself it cannot meet the objectives of most language curricula or standards, particularly those related to spoken language. Since the ability to communicate orally depends on opportunities to negotiate meaning through purposeful interaction, the efficacy of distance learning may rest, in part, on the quality and quantity of provision made for student interaction.

In the classroom:

Technology is increasingly used in all subjects as part of the teaching/learning process. In addition to the use of word processing software, video-supported instruction, and distance learning mentioned above, there are many ways that foreign language teachers can make use of technological tools.

An area that offers great promise, although little research has been conducted to date, is that of computer communications. Computer communications, particularly the online chat mode, have many of the features of oral discourse. They involve spontaneous, unrehearsed, informal language use that focuses on meaning rather than on form. Communication networks have a number of positive features that contribute to language development, including increased student participation and lowered anxiety levels due to the psychological distance imposed by computer-mediated communication.

The Internet and World Wide Web can provide access to resources that are richer and far more extensive than those available in most school or community libraries. Because these provide immediate access to authentic language and cultural resources, they can significantly impact the ways in which language is practiced and enrich opportunities for meaningful contact with the target language without physically leaving the classroom.

References:

Garza 1991; Oxford et al. 1993; Pusack and Otto 1995; Rubin 1990; Secules, Herron, and Tomasello 1992.

References

Adair-Hauck, Bonnie, Richard Donato and Philomena Cumo. 1994. "Using a Whole Language Approach to Teach Grammar." In *Teacher's Handbook. Contextualized Language Instruction*, J. Shrum and E. Glisan, editors (pp. 90-111). Boston, MA: Heinle & Heinle Publishers.

Asher, James. 1984. *Learning Another Language Through Actions: The Complete Teacher's Guidebook*. Los Gatos, CA: Sky Oaks Publications.

Bacon, Susan. 1992. "Phases of Listening to Authentic Input in Spanish: A Descriptive Study." *Foreign Language Annals* 25: 317-324.

Barnett, Marva. 1986. "Syntactic and Lexical/Semantic Skill in Foreign Language Reading: Importance and Interaction." *Modern Language Journal* Vol. 70: 343-349.

Barnett, Marva. 1995. "Reading." In *Research Within Reach II*, C. Herron and V. Galloway, editors (pp. 85-95). Valdosta, GA: Southern Conference on Language Teaching.

Byram, Michael and V. Esarte-Sarries. 1991. *Investigating Cultural Studies in Foreign Language Teaching: A Book for Teachers*. Clevedon, England: Multilingual Matters Ltd.

Carrell, Patricia L. 1984. "The Effects of Rhetorical Organization on ESL Readers." *TESOL Quarterly* Vol. 18: 441-469.

Celce-Murcia, Marianne. 1991. "Grammar Pedagogy in Second and Foreign Language Teaching." *TESOL Quarterly* Vol. 25. 3. 459-480.

Chamot, Ana U. and L. Kupper. 1989. "Learning Strategies in Foreign Language Instruction." *Foreign Language Annals* Vol. 22: 13-24.

Chamot, Ana U., J.M. O'Malley, L. Kupper, and M.V. Impink-Hernández. 1987. *A Study of Learning Strategies in Foreign Language Instruction: First Year Report*. Rosslyn, VA: InterAmerica Research Associates.

Chastain, Kenneth. 1990. "Characteristics of Graded and Ungraded Compositions." *Modern Language Journal* Vol. 74: 10-14.

Cooper, Thomas. 1981. "Sentence Combining: An Experiment in Teaching Writing." *Modern Language Journal* Vol. 65: 158-165.

Dekeyser, Robert M. 1993. "The Effect of Error Correction on L2 Grammar Knowledge and Oral Proficiency." *Modern Language Journal* Vol. 77: 501-514.

Doughty, Catherine and Teresa Pica. 1986. "'Information Gap' Tasks: Do They Facilitate Second Language Acquisition?" *TESOL Quarterly* Vol. 20: 305-325.

Ellis, Rod. 1990. *Instructed Language Acquisition*. Oxford, U.K.: Blackwell Publishers.

Ellis, Rod. 1993. "The Structural Syllabus and Second Language Acquisition." *TESOL Quarterly* Vol. 27: 91-112.

Fathman, Ann K. and E. Whalley. 1990. "Teacher Response to Student Writing: Focus on Form Versus Content." In *Second Language Writing: Research Insights for the Classroom*, Barbara Kroll, editor (pp. 178-190). New York: Cambridge University Press.

Garza, T.J. 1991. "Evaluating the Use of Captioned Video Material in Advanced Foreign Language Learning." *Foreign Language Annals* Vol. 24: 239-58.

Gass, Susan and E. Varonis. 1985. "Variation in Native Speaker Speech Modification to Non-Native Speakers." *Studies in Second Language Acquisition* Vol. 7: 37-57.

Gass, Susan and S.S. Magnan. 1993. "Second-Language Production: SLA Research in Speaking and Writing." In *Research in Language Learning*, A.O. Omaggio Hadley, editor (pp. 156-197). Lincolnwood, IL: National Textbook Company.

Glisan, Eileen W. 1988. "A Plan for Teaching Listening Comprehension: Adaptation of an Instructional Reading Model." *Foreign Language Annals* Vol. 31: 9-16.

Glisan, Eileen W. 1995. "Listening." In *Research Within Reach II*, C. Herron and V. Galloway, editors (pp. 61-83). Valdosta, GA: Southern Conference on Language Teaching.

Grabe, William. 1991. "Current Developments in Second Language Reading Research." *TESOL Quarterly* Vol. 25: 375-406.

Heilenman, L. Kathy. 1995. "Grammar Research Within Reach." In *Research Within Reach II*, C. Herron and V. Galloway, editors (pp. 129-148). Valdosta, GA: Southern Conference on Language Teaching.

Hillocks, George Jr. 1986. *Research on Written Composition: New Directions for Teaching*. Urbana, IL: ERIC Clearinghouse on Reading and Communication Skills and the National Conference on Research in English. (ED 265 552.)

Huebener, Thom and Anne Jensen. 1992. "A Study of Foreign Language Proficiency-Based Testing in Secondary Schools." *Foreign Language Annals* Vol. 25: 165-115.

Kaplan, R.B. 1966. "Cultural Thought Patterns in Intercultural Education." *Language Learning* Vol. 16: 1-20.

Krapels, Alexandra. 1990. "An Overview of Second Language Writing Process Research." In *Second Language Writing: Research Insights for the Classroom*, Barbara Kroll, editor (pp. 37-56). New York: Cambridge University Press.

Krashen, Stephen. 1982. *Principles and Practice in Second Language Acquisition*. Oxford, UK: Pergamon Press.

Krashen, Stephen. 1984. *Writing, Research, Theory and Applications*. Oxford, UK: Pergamon Press.

Lalande, J. 1982. "Reducing Composition Errors: An Experiment." *Modern Language Journal* Vol. 66: 140-49.

Larsen-Freeman, Diane and Michael Long. 1991. *An Introduction to Second Language Acquisition Research*. New York: Longman, Inc.

Lightbown, Patsy M. 1992. "Can They Do It Themselves? A Comprehension-Based ESL Course for Young Children." In *Comprehension-based Second Language Teacher/L'Enseignment des langues secondes axé sur la compréhension*, R. Courchêne, J. Glidden, J. St. John, and C. Therien, editors (pp. 353-370). Ottawa, Ontario: University of Ottawa Press.

Long, Michael H. and Patricia A. Porter. 1985. "Group Work, Interlanguage Talk, and Second Language Acquisition." *TESOL Quarterly* Vol. 19: 207-227.

Mantle-Bromley, Corinne. 1992. "Preparing Students for Meaningful Culture Learning." *Foreign Language Annals* 25: 117-127.

Met, Myriam. 1995. "Speaking." In *Research Within Reach II*, C. Herron and V. Galloway, editors (pp. 97-113). Valdosta, GA: Southern Conference on Language Teaching.

Met, Myriam and V. Galloway. 1991. "Research in Foreign Language Curriculum." In *Handbook of Research on Curriculum*, P. Jackson, editor. New York: Macmillan.

Mings, Robert C. 1993. "Changing Perspectives on the Utility of Error Correction in Second Language Acquisition." *Foreign Language Annals* Vol. 26: 171-179.

Nunan, D. 1991. "Communicative Tasks and the Language Curriculum." *TESOL Quarterly* Vol. 25: 279-295.

Olshtain, Elite. 1993. "Language in Society." In *Research in Language Learning*, A.O. Omaggio Hadley, editor (pp. 47-65). Lincolnwood, IL: National Textbook Company.

Omaggio, Alice C. 1993. *Teaching Language in Context*. Boston, MA: Heinle & Heinle Publishers.

O'Malley, J. Michael and A.U. Chamot. 1990. *Learner Strategies in Second Language Acquisition*. Cambridge, MA: Cambridge University Press.

O'Malley, J. Michael and A.U. Chamot. 1993. "Language Learner Characteristics in Second Language Acquisition." In *Research in Language Learning*, A.O. Omaggio Hadley, editor (pp. 96-123). Lincolnwood, IL: National Textbook Company.

Oxford, R. 1990. *Language Learning Strategies: What Every Teacher Should Know*. Rowley, MA: Newbury House.

Oxford, R., Y. Park-Oh, S. Ito, and M. Sumrall. 1993. "Japanese via Satellite: Effect of Motivation, Language Learning Styles and Strategies, Gender, Discourse Level, and Previous Language Learning Experience on Japanese Language Achievement." *Foreign Language Annals* Vol. 26: 359-71.

Phillips, June K. 1984. "Practical Implications of Recent Research in Reading." *Foreign Language Annals* Vol. 17: 285-96.

Phillips, June K. 1995. "Testing." In *Research Within Reach II*, C. Herron and V. Galloway, editors (pp. 161-174). Valdosta, GA: Southern Conference on Language Teaching.

Pusack, James P. and Sue K. Otto. 1995. "Instructional Technologies." In *Research Within Reach II*, C. Herron and V. Galloway, editors (pp. 23-41). Valdosta, GA: Southern Conference on Language Teaching.

Rieken, Elizabeth G. 1991. *The Effect of Feedback on the Frequency and Accuracy of Use of the Passé Composé by Field-Independent and Field-Dependent Students of Beginning French*. Unpublished Ph.D. dissertation, University of Illinois at Urbana-Champaign.

Robinson, Gail. 1981. *Issues in Second Language and Cross-Cultural Education: The Forest Through the Trees*. Boston, MA: Heinle & Heinle Publishers.

Rubin, Joan. 1981. "Study of Cognitive Processes in Second Language Learning." *Applied Linguistics* Vol. 11: 117-31.

Rubin, Joan. 1990. "Improving Foreign Language Listening Comprehension." In *Georgetown University Round Table on Languages and Linguistics*, J.E. Alatis, editor. Washington, DC: Georgetown University Press.

Rubin, Joan. 1995. "Learning Processes and Strategy." In *Research Within Reach II*, C. Herron and V. Galloway, editors (pp. 11-22). Valdosta, GA: Southern Conference on Language Teaching.

Savignon, Sandra J. 1991. "Communicative Language Teaching: State of the Art." *TESOL Quarterly* Vol. 25: 261-77.

Schmidt, R. and S. Frota. 1986. "Developing Basic Conversational Ability in a Second Language: A Case Study of an Adult Learner of Portuguese." In *Talking to Learn: Conversation in Second Language Acquisition*. R. Day, editor (pp. 237-326). Rowley, MA: Newbury House.

Secules, T., C. Herron, and M. Tomasello. 1992. "The Effect of Video Context on Foreign Language Learning." *Modern Language Journal* Vol. 76: 480-490.

Shohamy, Elana. 1984. "Does the Testing Method Make a Difference? The Case of Reading Comprehension." *Language Testing* Vol. 1: 147-170.

Shohamy, Elana. 1991. "Connecting Testing and Learning in the Classroom and on the Program Level." In *Building Bridges and Making Connections*, June K. Phillips, editor. South Burlington, VT: Northeast Conference.

Shohamy, Elana. 1994. "The Validity of Direct vs. Semi-direct Oral Tests." *Language Testing* Vol. 11: 99-123.

Shrum, J. and E. Glisan. 1994. *Teacher's Handbook: Contextualized Language Instruction*. Boston, MA: Heinle & Heinle Publishers.

Swain, Merrill. 1985. "Communicative Competence: Some Roles of Comprehensible Input and Comprehensible Output in Its Development." In *Input in Second Language Acquisition*. Susan Gass and C. Madden, editors. Rowley, MA: Newbury House.

Underhill, Nic. 1987. *Testing Spoken Language*. Cambridge, UK: Cambridge University Press.

Van Patten, Bill. 1993. "Grammar Teaching for the Acquisition-Rich Classroom." *Foreign Language Annals* Vol. 26: 435-450.

Wenden, A. 1991. *Learner Strategies for Learner Autonomy*. Englewood Cliffs, NJ: Prentice-Hall International.

Wolf, Darlene. 1993. "A Comparison of Assessment Tasks Used to Measure FL Reading Comprehension." *Modern Language Journal* Vol. 77: 473-488.

Chapter 5. Health Education

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This chapter consists of six practices, which use a range of interactive teaching and learning methods that are gaining prominence in health education. These practices are based on one primary goal: that students will be able to apply the knowledge and skills taught in health education to their own lives. Teaching for permanent, positive changes in behaviors requires that students practice these behaviors with peers, think reflectively and critically about the consequences of both positive and negative health decisions, and take responsibility for the decision-making process.

The importance of an effective health curriculum is clear when we consider the social consequences of unhealthy behaviors learned early in life. National health statistics reveal growing problems among adolescents associated with use of alcohol and tobacco, sexually transmitted diseases, and pregnancy. For example, although youths ages 16 to 24 make up only 17 percent of all drivers, they accounted for 38 percent of alcohol-related fatal crashes in 1986 (U.S. Department of Health and Human Services 1990). Moreover, approximately 50 percent of smokers in the U.S. began smoking regularly before age 18. Eighty-six percent of all sexually transmitted diseases occur among persons ages 15 to 29 (Centers for Disease Control and Prevention 1992). The United States' teen pregnancy rate is twice as high as that of other industrialized countries. Two in five girls become pregnant, and one in five bears a child, before the age of 20 (Children's Defense Fund 1990).

The Centers for Disease Control and Prevention (1992) reports that a high percentage of morbidity and mortality are caused by six categories of risk behaviors: 1) use of alcohol and other drugs, 2) participation in behaviors that result in sexually transmitted diseases including HIV, 3) use of tobacco, 4) poor nutrition, 5) physical inactivity, and 6) intentional and unintentional injury (Dalis 1993, 9.15). These behaviors are learned by children and youth and carried into adulthood. For these reasons, a comprehensive and effective health education curriculum is not only critically important to the health and well-being of every school-age child, but is also a viable means of addressing the escalating costs of health care.

The Joint Committee on National Health Education Standards (1995) has developed seven standards that should be addressed in health education. Students should be able to:

- comprehend health promotion and disease prevention concepts;
- access valid health information and appropriate health products and services;
- practice health-enhancing behaviors and reduce health risks;
- analyze the impact of culture, media, technology, and other societal factors on health;
- use interpersonal communication skills that enhance health;
- use goal-setting and decision-making skills that enhance health; and
- advocate for personal, family, and community health.

The Committee's report defines health literacy as "the capacity of individuals to obtain, interpret, and understand basic health information and services and the competence to use such information and services in ways which enhance health" (1995, 5). The health-literate person, according to the report, is: 1) a critical thinker and problem solver; 2) a responsible, productive citizen; 3) a self-directed learner; and 4) an effective communicator (1995, 5). Use of these standards and characteristics can provide structure and guidance for the content of school health education programs.

5.1. Developing Personal Competence: Students who develop personal competence are more likely to make a commitment to positive health behaviors.

Research findings:

The body of research surrounding the concept of personal competence focuses on the efficacy of personal skill development. These strategies are aimed at developing the student's self esteem, self-management skills, and internal locus of control.

In research conducted in a range of settings with heterogeneous target populations, personal competence training has proven successful in reducing unhealthy choices such as teenage pregnancy and tobacco, alcohol, and drug abuse.

In the classroom:

Personal competence includes the ability to make logical and rational decisions without being unduly influenced by others. After students have been made aware of alternative modes of behavior, they need to understand that they do, in fact, control decisions that lead to positive health behaviors. Commitment to healthy living can occur only when the individual understands the controlling factors involved in a decision and is willing to practice self-management even when decisions prove unpopular with peers. Students should learn coping skills to manage stress and anxiety and increase their own sense of personal control.

Coping skills can be taught in a variety of health education units. They can be integrated, for example, within units on tobacco, alcohol, and family skills. Caring for self, both physically and psychologically, is a primary objective of these units. Some students, unfortunately, may never have experienced feelings of care. They may not have been cared for by others. Teachers should demonstrate caring behaviors and articulate explicit aspects of caring to assist all students to learn to care for themselves.

References:

Botvin 1992; Botvin, Baker, Dusenbury, Tortu, and Botvin 1990; Botvin, Baker, Filazzola, and Botvin 1990; Botvin and Dusenbury 1992; Braun 1992; Elias et al. 1986; Flay 1985; Pentz 1985; Pentz and Kazdin 1982; Schinke 1984; Spivack and Shure 1982; Weissberg et al. 1981.

5.2. Developing Social Competence: Students who develop effective interpersonal communication skills can withstand peer pressure to engage in unhealthy practices.

Research findings:

Researchers are using social learning and behavior theories as the basis for assessing strategies to develop social competence. Although the application of these theories to classroom instruction in health education is relatively recent, it appears to hold promise for identifying a range of strategies that are effective in making students 1) aware of negative peer influences, 2) cognizant of strategies to confront and reject peer pressures, and 3) able to select and engage in positive health behaviors.

In the classroom:

Interpersonal skills include the ability to communicate with others, listen attentively, demonstrate consideration, and respect others. Students gain these skills through social interaction in situations with varying levels of conflict. Teachers can structure various environments, from that of low conflict (friends discussing an issue about which they all agree) to high conflict (individuals from different neighborhoods discussing issues that are sources of conflict). Teachers need to help students develop and demonstrate effective interpersonal and communication skills to resolve conflicts peacefully instead of fighting.

Social skills curricula and teaching strategies are based on communication skills (verbal and nonverbal), avoiding misunderstandings, overcoming shyness, initiating conversations, receiving compliments, and acquiring skills needed to maintain close interpersonal relationships. Assertiveness training is also part of these curricula as students learn when to refuse and when to initiate actions. They learn to seek out situations that are conducive to healthy practices while avoiding those that are dangerous to themselves and others. Strategies are taught using role playing or behavioral rehearsal between two or more individuals to provide practice in performing these skills.

References:

Botvin 1992; Botvin et al. 1989; Botvin, Baker, Dusenbury, Tortu, and Botvin 1990; Botvin, Baker, Filazzola, and Botvin 1990; Coombs and Slaby 1977; Elias et al. 1986; Flay 1985; Spivack and Shure 1982; Weissberg et al. 1981.

5.3. Practice in Goal Setting and Decision Making: Instruction that enhances students' goal-setting and decision-making skills will contribute to their ability to make positive health decisions.

Research findings:

Research results show that goal setting and decision making are critical to behavioral change, and that substantive changes in behavior are unlikely to occur without conscious effort. Findings suggest that students must be: 1) aware of the problem and acknowledge it, 2) nurtured in their efforts to make a commitment to the behavioral change, and 3) able to use effective strategies to make the desired change. Strategies that are most effective involve individual ownership of the goal-setting and decision-making process, since individuals' lifestyles are influenced by the goals they establish. Research also indicates that individuals commonly make a number of "false starts" in their efforts to set and meet goals for behavioral change.

In the classroom:

Health educators should be accepting of failed attempts as part of the process of setting priorities and developing commitment for change. They can offer support for individuals and encourage them to continue to develop realistic goals, allow adequate time to reach those goals, and further develop strategies to affect permanent change. Goal setting and decision making enable individuals to structure and focus their efforts to acquire positive health behaviors.

Students need opportunities to transfer health knowledge into decisions about their personal health needs. Individuals often make decisions that over- or underestimate their ability to reach a goal. They need assistance to set and work toward their goals using a reasonable time frame. Behavioral changes take time. Saying that you want to stop smoking does not often translate into immediately reaching this goal. Students need to be helped to understand how to effectively set and meet realistic goals, and to realize that goals may need to be set in stages that lead progressively to behavioral change. Decision making skills involve evaluating factual information about health issues as well as one's own personal lifestyle to select a course of action that is reasonable and that will lead to success. Students need opportunities to set personally meaningful goals and to strive to reach them. They need to experience the consequences of success and failure in situations that are safe and supportive.

Goal-setting and decision-making strategies are part of a larger curricular focus on learning for understanding that originates in constructivist education. Constructivism asserts that knowledge and courses of action are based on reasoned decisions that are personally and socially constructed by the individual. Although knowledge can be useful in formulating a plan, it is the student's values and beliefs that ultimately determine the course of action (see Practice 5.4). A constructivist approach to health education focuses on the learner's reasons for learning and his/her need to make sense of knowledge. It requires thought-demanding experiences that lead students to ask pertinent questions and motivate them to consider culturally and intellectually challenging solutions to difficult problems.

References:

Brooks and Brooks 1993; Dalis 1994; Duffy and Jonassen 1992; Elias and Kres 1994; Tobler 1986.

5.4. Development of Values Awareness: Students who understand their own values and those of others can associate values with positive and productive courses of action.

Research findings:

Values are internally controlled and subject to personal adjustment. Research supports the importance of assisting students to understand how their values determine their feelings and actions.

Values clarification, used extensively in many health education programs, is one of the most researched strategies in health education. Researchers have found that the development of a supportive, neutral environment is a critical factor in the success of values clarification, and that this is also the most difficult factor for teachers to manage when using this strategy.

In the classroom:

The primary goal of instruction in values awareness is to help young people develop their own value structure, and to heighten students' awareness of their own values and the role that values play in decision making related to positive health behaviors. Teachers begin by selecting an activity or question for discussion that requires students to make judgments or propose courses of action. They are asked to share their rationales for their decisions with a partner, a small group, or the class. Teachers help students to link these reasons to values, and may encourage them to analyze their values based on personal or community expectations. Teachers should avoid influencing or judging students' responses. They should establish and maintain a nonjudgmental environment that encourages open, responsible communication.

Values awareness depends on the use of active strategies that encourage students to become involved in their own learning. Rather than imposing external values on students, teachers encourage students to examine their own values and compare them to good health practices.

Educating students to be supportive of each other while simultaneously asking thought-provoking questions takes time and careful planning. Encouraging students to analyze and critique their own values can be challenging, particularly when students have acquired and value unhealthy courses of action. Health educators need to be skillful in structuring the discussion to lead students to evaluate their actions as they impact their own lives and those of others.

References:

Association for the Advancement of Health Education 1992; Braun 1992; Dalis 1994; Dalis and Strasser 1981; Duffy and Jonassen 1992; Morrow 1987; Raths, Harmin, and Simon 1966; Wallerstein and Bernstein 1988.

5.5. Practice in Critical Analysis of Health Information: Instruction that increases students' ability to analyze and critically examine the health messages promoted in the media and culture helps them make informed health choices.

Research findings:

Research has confirmed the influence of the media and advertising in glamorizing negative health messages. Advertising messages sometimes portray smoking as "cool" in an effort to sell cigarettes, and communicate the message that sex is a right without responsibilities or consequences. Although some attempts have been made to limit negative forms of advertising, as well as the portrayal of unsafe and unhealthy practices in movies and videos, the fact remains that the excitement and intuitive appeal of risk-taking is tremendously powerful and compelling for adolescents. Research suggests that the process of helping students reflect on and critically examine these media messages requires long time periods and intensive interactions. Researchers are continuing their efforts to identify strategies that are sufficiently powerful to combat the alluring messages that pervade the consciousness of adolescents.

In the classroom:

It is essential that students learn to analyze and evaluate a variety of positive and negative health messages to determine the credibility of the information and the extent to which it should influence their lives. Students should learn to analyze the role of cultural beliefs in determining positive health practices. Awareness of cultural diversity may both enrich and challenge anecdotal and research-based information.

As consumers, students need to acquire the critical thinking skills of information gathering, synthesis of concepts and ideas, and analysis and evaluation of the messages within their lives. Further, the development of a critical perspective that includes strategies to question long-held beliefs may be instrumental in encouraging some individuals to consider alternative and more positive health behaviors. Teachers can teach and use divergent questioning models, such as brainstorming and involvement (placing oneself in a hypothetical situation), to help students develop critical thinking skills.

Negative health messages often originate in glitzy presentations on television, videos, and in movies. These messages are powerful and persuasive, and they often include misleading interpretations of statistics. Instructional methods that incorporate analysis and critique teach students to use critical thinking skills to recognize false information and develop personally satisfactory alternatives.

References:

Cinelli et al. 1995; Elias et al. 1986; Ennett et al. 1994; Gregory 1991; Joint Committee on National Health Education Standards 1995; Pentz 1985; Schinke 1984; Spivack and Shure 1982; Wallerstein and Bernstein 1988.

5.6. Activity-Oriented, Interactive Learning: Interactive teaching strategies are more likely to result in student examination of alternative courses of action, leading to the development of positive lifestyle choices.

Research findings:

A solid base of research and experience indicates that an activity-oriented health education program that encourages students to think, explore, and investigate health topics for themselves is more effective in encouraging students to make wise health decisions than a program that depends mainly on lecture or textbooks. The U.S. Public Health Service recommends an instructional approach that includes activity-oriented curricula, participatory classroom activities, small-group work, and peer interaction. Other specific instructional approaches found to be effective include role-playing and cooperative learning.

In the classroom:

Students need opportunities to examine both positive and negative lifestyle choices through interaction with curriculum materials, peers, and teachers. Rather than simply lecturing students on positive choices, teachers should provide opportunities for students to consider the consequences of several courses of action. Activity-oriented teaching strategies include vignettes, values clarification exercises, role playing, and dialogue. These strategies often require students to get out of their chairs and interact with peers in the decision-making process.

References:

Botvin, Baker, Dusenbury, Tortu, and Botvin 1990; Botvin, Baker, Filazzola, and Botvin 1990; Cinelli et al. 1994; Gold 1994; National Commission on the Role of the School and Community in Improving Adolescent Health 1990; Pentz and Kazdin 1982; Spivack and Shure 1982; U.S. Department of Health and Human Services 1993.

References

Association for the Advancement of Health Education. 1992. "A Point of View for Health Education." *Journal of Health Education* Vol. 23, No. 1: 4-6.

Botvin, G.J. 1992. "Personal and Social Skills Training Applications for Substance Abuse Prevention." In *Strengthening Health Education for the 1990s* (pp. 29-38). Reston, VA: Association for the Advancement of Health Education.

Botvin, G.J., L. Dusenbury, E. Baker, D. James-Ortiz, and J. Kerner. 1989. "A Skills Training Approach to Smoking Prevention in Hispanic Youth." *Journal of Behavior Medicine* Vol. 12: 279-296.

Botvin, G.J., E. Baker, L. Dusenbury, S. Tortu, and E. Botvin. 1990. "Preventing Adolescent Drug Abuse Through a Multimodal Cognitive-Behavioral Approach: Results of a Three-Year Study." *Journal of Consulting and Clinical Psychology* Vol. 58, No. 4: 437-445.

Botvin, G.J., E. Baker, A.D. Filazzola, and E. Botvin. 1990. "A Cognitive-Behavioral Approach to Substance Abuse Prevention: A One-Year Follow-up." *Addictive Behaviors* Vol. 15: 47-63.

Botvin, G.J. and L. Dusenbury. 1992. "Substance Abuse Prevention: Implications for Reducing the Risk of HIV Infection." *Psychology of Addictive Behaviors* Vol. 6, No. 2: 70-80.

Braun, J.A. 1992. "Caring, Citizenship, and Conscience: The Cornerstones of a Values Education Curriculum for Elementary Schools." *International Journal of Social Education* Vol. 7, No. 2: 47-56.

Brooks, J.G. and M.G. Brooks. 1993. *The Case for Constructivist Classrooms.* Alexandria, VA: Association for Supervision and Curriculum Development.

Centers for Disease Control and Prevention. 1992. *Chronic Disease and Health Promotion Reprints.* Atlanta: Author.

Children's Defense Fund. 1990. *Children* [pamphlet]. Washington, DC: Author.

Cinelli, B., C.W. Symons, L. Bechtel, and M.R. Colley. 1994. "Applying Cooperative Learning in Health Education Practice." *Journal of School Health* Vol. 64, No. 3 (March): 99-102.

Cinelli, B., L.J. Bechtel, M.R. Colley, and R. Nye. 1995. "Critical Thinking Skills in Health Education." *Journal of Health Education* Vol. 26, No. 2 (March/April): 119-120.

Coombs, M.L. and D.A. Slaby. 1977. "Social Skills Training with Children." In *Advances in Clinical Child Psychology, I,* B.B. Lakey and A.E. Kazdin, editors (pp. 161-201). New York: Plenum Press.

Dalis, G.T. 1993. "Health Education/Healthy, Active Living." In *The Curriculum Handbook.* Alexandria, VA: Association for Supervision and Curriculum Development.

Dalis, G.T. 1994. "Effective Health Instruction: Both a Science and an Art." *Journal of Health Education* Vol. 25: 289-294.

Dalis, G.T. and B.B. Strasser. 1981. "Teach Values in Health Education." In *Education in the 80s: Health Education,* R. Russell, editor (pp. 116-122). Washington, DC: National Educational Association.

Duffy, T.M. and D.H. Jonassen. 1992. *Constructivism and the Technology of Instruction: A Conversation.* Hillsdale, NJ: Laurence Erlbaum.

Elias, M.J. and J.S. Kres. 1994. "Social Decision-Making and Life Skills Development: A Critical Thinking Approach to Health Promotion in the Middle School." *Journal of School Health* Vol. 64, No. 2 (February): 62-66.

Elias, M., M. Gara, M. Ubriaco, P.A. Rothbaum, J.F. Clabby, and T. Schuyler. 1986. "Impact of a Preventive Social Problem Solving Intervention on Children's Coping with Middle School Stress." *American Journal of Community Psychology* Vol. 14: 259-275.

Ennett, S.T., M.S. Tobler, C.L. Ringwalt, and R.L. Flewelling. 1994. "How Effective is Drug Abuse Resistance Education? A Meta-Analysis of Project DARE Outcome Evaluations." *American Journal of Public Health* Vol. 84, No. 9: 1394-1401.

Flay, B.R. 1985. "Psychosocial Approaches to Smoking Prevention: A Review of the Findings." *Health Psychology* Vol. 4, No. 5: 449-488.

Gold, R.S. 1994. "The Science Base for Comprehensive Health Education." In *The Comprehensive School Health Challenge (Volume 2),* P. Cortese and K. Middleton, editors (pp. 545-573). Santa Cruz, CA: ETR Associates.

Gregory, R. 1991. "Critical Thinking for Environmental Health Risk Education." *Health Education Quarterly* Vol. 18, No. 3: 273-284.

Joint Committee on National Health Education Standards. 1995. *Health Education Standards.* Reston, VA: Association for the Advancement of Health Education. Also available from American School Health Association and American Cancer Society.

Morrow, S.R. 1987. "Values and Moral Education: Revisited." *Councilor* Vol. 47: 31-33.

National Commission on the Role of the School and Community in Improving Adolescent Health. 1990. *Code Blue: Uniting for Healthier Youth.* Alexandria, VA: National Association of State Boards of Education and American Medical Association.

Pentz, M.A. 1985. "Social Competence Skills and Self-Efficacy as Determinants of Substance Use in Adolescence." In *Coping and Substance Abuse,* S. Shiffman and T.A. Willis, editors. New York: Academic Press.

Pentz, M.A. and A.E. Kazdin. 1982. "Assertion Modeling and Stimuli Effects on Assertive Behavior and Self Efficacy in Adolescents." *Behavioral Research and Therapy* Vol. 20: 365-371.

Raths, L.E., M. Harmin, and S.B. Simon. 1966. *Values and Teaching.* Columbus, OH: Charles E. Merrill.

Schinke, S.P. 1984. "Preventing Teenage Pregnancy." In *Progress in Behavior Modification, 16,* M. Hersen, R.M. Eisler, and P.M. Miller, editors (pp. 31-63). New York: Academic Press.

Spivack, G. and M.D. Shure. 1982. "The Cognition of Social Adjustment: Interpersonal Cognitive Problem-Solving Thinking." In *Advances in Child Clinical Psychology*, 5, B.B. Lakey and A.E. Kazdin, editors (pp. 323-372). New York: Plenum Press.

Tobler, N.S. 1986. "Meta-Analysis of 143 Adolescent Drug Prevention Programs: Quantitative Outcome Results of Program Participants Compared to a Control or Comparison Group." *Journal of Drug Issues* Vol. 16: 537-567.

United States Department of Health and Human Services. 1990. *Prevention '89/'90: Federal Programs and Progress.* Washington, DC: Author.

United States Department of Health and Human Services. 1993. *School Health: Findings from Evaluated Programs.* Washington, DC: Author.

Wallerstein, N. and E. Bernstein. 1988. "Empowerment Education: Freire's Ideas Adapted to Health Education." *Health Education Quarterly* Vol. 15, No. 4: 379-394.

Weissberg, R.P., E.L. Gesten, C.L. Carnrike, P.A. Toro, B.D. Rapkin, E. Davidson, and E.L. Cowen. 1981. "Social Problem-Solving Skills Training: A Competence Building Intervention with Second to Fourth Grade Children." *American Journal of Community Psychology* Vol. 9: 419-423.

Chapter 6a. Language Arts

James R. Squire

Reading, writing, and oral language are the bedrock subjects of the curriculum, for they develop the competencies on which virtually all subsequent instruction and learning depends. Together with literature, which introduces young people to the ideas and values of their own and other cultures, these subjects constitute a segment of the curriculum that occupies from about 60 percent of school time at the primary school level to about 17 percent of school time at the secondary level. Unless boys and girls develop competence in using language, they will be handicapped throughout schooling and life.

The 12 practices identified in this chapter deal with the language arts as a whole, including the three major components of reading, writing, and oral language. A separate sub-chapter by Carolyn Dunkle Perry follows that deals with specific practices relating only to oral language.

For almost all of this century, teaching strategies and learning practices that are effective in the language arts have been vigorously researched. Yet, over these decades, the profession has continuously debated the desirability of various approaches. Disagreements have focused on the need for carefully controlled instruction versus the benefits of more open-ended, creative, and exploratory approaches. Many maintain that learners must be taught the needed skills and strategies; others, that learners will develop the needed competencies as they are engaged in meaningful language activities. Yet it seems clear that learners reap benefits from both kinds of teaching and that the most desirable overall approach combines instruction on key skills and strategies within a rich learning environment that stimulates reading, writing, and talking.

A review of the literature related to teaching and learning of the language arts also makes clear the interrelationships between many of the practices discussed in the following pages. Research points to the positive connection between extensive reading and improved reading comprehension. Providing opportunities for students to discuss what they have read—to become active participants in making meaning from written text—has also been proven to help students' reading skills to grow. This second approach also has positive effects on the first, since students who are provided with time and opportunity to share their thoughts about reading tend to read more.

The teaching of strategies to help students comprehend what they are reading is another approach that results in more than one positive outcome. Students not only understand more of what they are reading; again, they tend to read more. This linkage has a commonsense base. As reading becomes easier and more understandable, it becomes more enjoyable and students are likely to do more of it.

Similar relationships can be found between many of the 12 research-based approaches discussed in this section on the language arts. Instruction that effectively integrates them in the daily life of the classroom will be a strong force both for improving the reading and writing skills of students and for encouraging them to make reading part of their lives outside as well as inside school.

6a.1. Extensive Reading: Extensive reading of material of many kinds, both in school and outside, results in substantial growth in the vocabulary, comprehension abilities, and information base of students.

Research findings:

Research has demonstrated that time spent reading, both inside and outside of school, is essential to developing cognitive abilities such as comprehension and vocabulary. Reading of many different types of material also has benefits, since students then see words in a variety of contexts. The meanings of these words are then more readily accessible during future reading. Students with both low- and high-level literacy skills benefit from time spent reading, with vocabulary learned from context and comprehension improved if the difficulty of the material presented is appropriate to the current reading level.

Yet recent studies demonstrate that most children spend no more than a few minutes a day reading in school or outside, on either assigned or independent reading. In addition, students with low reading skill levels are found to spend even less classroom time reading and more working on skill-based approaches.

Research has also found that an increase in the amount and breadth of independent reading, when paired with the presentation of strategies for improving comprehension, is associated with instruction that provides opportunities for students to discuss and share what they read.

In the classroom:

Young people need large blocks of time within the school day to read, with time for text reading considered an essential aspect of comprehension instruction. Students should be helped to select material that is of a suitable level of difficulty, so that the text can be comprehended but the reading activity will also result in new learning.

An atmosphere that encourages reading outside as well as inside the classroom can be provided by teachers who schedule time for students to talk to each other about the books they have read, to engage in shared reading, and to give personal reactions and interpretations of text.

School resources can be allocated to encourage reading of many types by students. Books in classrooms and in the school library should be of different types and cover a variety of topics. In addition, school time should be organized to encourage reading activities not only in language arts but in other subject areas such as social studies and science. To help teachers decide what balance of activities is appropriate, schools need to be explicit about the dimensions of cognitive growth that are to be considered essential aspects of the educational program. These might include language concepts and the ability to analyze, synthesize, and make informed judgments based on valid criteria, all skills strengthened by reading and discussing what was read.

References:

Allington 1994; Anderson et al. 1985; Anderson, Wilson, and Fielding 1988; Fielding and Pearson 1994; Guthrie et al. 1995; LaBrant 1961; Nagy, Anderson, and Herman 1987.

6a.2. Interactive Learning: Learning in which children and young people are interactive produces far more effective growth than instruction in which they are passive.

Research findings:

John Dewey emphasized that we learn from experience, and that activities become experience only as we think about and act upon them. Vgotsky, Piaget, and Britton reported similar observations. Reading, characterized as "highly interactive and reciprocal," fits well within this context. Part of the experience involves the reader-author connection, but research also stresses the importance of student-student and student-teacher interaction; discussing what has been read adds another dimension to the experience and expands the reader's understanding.

Research in strategic teaching and learning is becoming increasingly specific about what can be learned through cooperative activity or interactive processes. It demonstrates that such social processes, when compared with individual study, can stimulate greater growth for learners. In the area of the language arts, this can result in both an expanded vocabulary and higher levels of comprehension.

In addition, social time spent talking about reading—sharing, asking questions, explaining—has been demonstrated to increase the amount of reading students do, and so contributes in an additional way to improving reading skills.

In the classroom:

Language learning comes not from the activity itself but from thinking about, writing about, or talking about the activity. As the great linguist C.C. Fries observed, "There is no language save for the speaker active in expression." Readers and writers must be encouraged to think about and discuss what they are reading, writing, and doing if they are to learn. Talking about ideas also helps young people think through the ideas. When Purves stressed that "it takes two to read a book," he was referring to research which indicates that learning from reading comes from writing about and talking about what is read. Hence, classrooms in which young people are active in using language are essential in teaching the language arts.

The sharing opportunities can take many forms: reading partners, cooperative learning groups, reading journals passed back and forth between student and teacher, whole-class discussions, or presentation of reports. What is more important than the type of activity is that students are actively rather than passively engaged.

When time is provided to discuss reading done outside as well as inside class, students are also encouraged to read more and to read more widely than would be possible in the time available in class.

References:

Britton 1970; Dewey 1933; Dole et al. 1991; Goodman, Hood, and Goodman 1991; Johnson, Johnson, and Holobec 1991; Piaget 1959; Pressley et al. 1990; Purves and Beach 1972; Vgotsky 1978.

6a.3. Extension of Background Knowledge: Reading comprehension is enhanced when readers extend their experience and background knowledge and develop their sensitivity to increasingly difficult concepts and complex patterns of language.

Research findings:

Recent research emphasizes the significance of background knowledge in reading comprehension. The more a reader knows about a topic, the better his or her comprehension of newly encountered writing about the topic, and the less that has to be "filled in" by someone who may be unclear about the intent of the author. Background knowledge combines with basic skills such as vocabulary in order to make the text understandable. Thus, students who have low basic skills but high background knowledge about the topic being discussed may be able to understand what the author intended even if the words used are difficult.

In the process of comprehending the text, the reader gains more background knowledge to be used in understanding future texts. A reader's background knowledge can include either general issues related to the text or subject-matter knowledge relevant to the text. The combination of background knowledge available allows a reader to make inferences about meanings in a text, and thus to comprehend it. Extensive reading, another of the research-based factors shown to improve reading comprehension and vocabulary, is an important factor in increasing the bank of background knowledge available to a reader.

In the classroom:

Each reading experience both benefits from and enhances background knowledge; new words and meanings are added to background knowledge through reading. Schools and teachers can help with the critical need to expand background knowledge by providing time for students to read and a supply of books that are both interesting and varied.

Teachers can also supply background knowledge in other ways: pre-teaching vocabulary before it is presented in text, enriching background knowledge through previews or by highlighting background knowledge that students are known to have, or assessing students' present level of background knowledge and then selecting additional resources that can help to fill gaps in areas that would hinder comprehension.

Methods of linking background knowledge to the text might include using advance organizers; providing students with objectives or purposes for the text; and using pretests or prequestioning. Direct instruction in how to use background knowledge to make inferences about unfamiliar text may also help students. For example, having students predict what will happen in a story requires them to draw on both their understanding of the text and their background knowledge.

References:

Anderson and Pearson 1984; McCabe and Peterson 1991; Nagy 1988; Strickland 1962; Tierney and Cunningham 1984.

6a.4. Instruction in Strategic Reading and Writing: Activities that enable students to apply meaning-making skills and strategies such as summarizing, questioning, and interpreting contribute to improved reading comprehension and written composition.

Research findings:

Research on strategic reading and writing has been a primary focus of studies during recent years as cognitive psychologists (those concerned about the development of thinking abilities) have turned their attention to the learning of language. Studies of good and poor readers have provided especially important insights. Specifically, good readers spontaneously use a wide range of strategies when unfamiliar text or tasks are encountered, while poor readers are unlikely to do so. A number of cognitive strategies useful to readers and writers have been developed and can be taught to students.

In the classroom:

Teachers should become familiar with the variety of cognitive strategies that students can use to improve their reading comprehension and writing ability. Strategies that have been identified include using background knowledge, previewing, setting goals, determining importance, evaluating content, generating questions, predicting, and summarizing as well as many others. These strategies may take place before, during, or after an event of reading or writing, and can be applied over a number of subject areas. The challenge for teachers is getting students to understand and apply the strategies during reading and writing.

Modeling of the strategy for students is an important component of instruction. Other important components are explaining how the strategy will help with learning, selecting strategies appropriate to the learner and the context, and providing feedback and encouragement as the student learns to use them. Group activities can be used to introduce and implement cognitive strategies. For example, students in a group may develop predictions about a story after having read part of it, identify strategies they each used to understand unfamiliar words, and develop a group summary of the story.

The most significant learning occurs after the act of reading, as the individual thinks about the ideas themselves and the ways in which they are presented. Thus, strategies that focus on this aspect of the reading-writing process are critical. Teachers' conferences with their students offer an effective way to encourage young people to reflect on what they have been reading or writing, as do other instructional strategies that help readers elaborate on the ideas they are reading or writing about, and thus promote higher thought processes and the ability to think more critically. Children consistently demonstrate improved understanding after engaging in such activities.

References:

Cazden 1991; Flood and Lapp 1991; Freedman 1987; Haller, Child, and Walberg 1988; Hill 1991; McLain 1991; Palincsar and Brown 1985; Paris, Wasik, and Turner 1991; Wittrock 1990.

6a.5. Interrelated Activities: Organizing instruction into broad, thematically based clusters of work through which reading, writing, and speaking activities are interrelated promotes understanding of the connections among activities and ideas.

Research findings:

Although individuals have long advocated interrelating reading, writing, speaking, and listening in the classroom, research demonstrating the power of such approaches has begun to appear only during the last decade: first, with respect to preschool and early language development; more recently, with respect to teaching in the upper grades.

In the classroom:

Thematic instruction provides an ideal framework for the classroom teacher who wants students to make the connection between reading, writing, and speaking. Activities designed around a unifying theme build on each other rather than remaining as fragmented disciplines. A connection of ideas as well as of related skills provides opportunities for reinforcement. For example, students who are learning to identify the main points in a story can, as a prewriting strategy, develop main points for their own stories.

When concepts are developed over a period of time so that one day's reading prepares students for discussion or writing, and the discussion of that writing in turn leads to more reading and writing, young people are more likely to grasp the connections among ideas and to develop and understand broad generalizations. If each day's reading, writing, and discussion relates to that done on earlier days and foreshadows upcoming activities, students will begin to see precedents as well as consequences and transitions from one version to another.

Skills development can also be an important outcome of this integrated approach. The spelling and structure of beginning writers improve as more experience with reading is provided. As they begin to write and realize that the purpose of writing is to convey an idea, they understand better that authors are creating messages for them.

References:

Allington 1994; Chall and Jacobs 1995; Freedman and McLeod 1988; Goodman, Hood, and Goodman 1991; Harste and Short 1988; Hartman 1995; Maguire 1994; Moffett and Wagner 1983; Pressley et al. 1990; Shaughnessy 1977.

6a.6. Teaching Critical Reading/Writing Skills: The teaching of critical skills such as word attack or grammar in reading and writing helps students develop competence in such skills within a reasonable period of time. Such instruction may be embedded in the total context of language learning or may be presented directly by the teacher.

Research findings:

Research has consistently demonstrated that many children will not automatically acquire all the basic skills needed for reading and writing and so may have to be taught some of them through direct instruction. Thus, poor readers, who read less and so have fewer opportunities to successfully practice skills such as word identification, remain poor decoders unless they receive specific skills instruction.

However, research has also pointed to the need for a balance between instruction in basic skills and instruction in context even for poor readers or writers. For example, when instruction for children with reading problems provides skills-based instruction to the exclusion of ample opportunities to read for meaning, the development of both vocabulary and reading comprehension skills suffer.

In the classroom:

There are many effective ways to teach reading and writing skills to young people. The skills may be embedded in a total language context or taught directly by the teacher. If taught directly, however, such instruction must include not only time for young people to learn skills, but ample experience in applying them. For example, if children are taught the sounds of words, opportunities to identify the words in a meaningful context should also be available.

References:

Adams 1990; Allington 1994; Chall 1967, 1983; Clay 1991; Farrell 1991; Indrisiano and Paratore 1991; Lyons, Pinnell, and Deford 1993; Palincsar and Brown 1985; Rosenshine and Stevens 1984.

6a.7. Discussion and Analysis: Instruction that emphasizes discussion and analysis rather than rote memory contributes most effectively to development of students' thinking abilities.

Research findings:

Research has consistently demonstrated that most young people will reach their potential in developing higher thought processes only if these processes are taught and practiced. Ability to recall information may also improve as the student creates a context in which to remember facts.

In the classroom:

Teachers should avoid excessive reliance on questions that require no more than recall of information. Frequent use of true-false, multiple-choice, and short-answer questions may teach students to respond quickly to certain kinds of tests, but it does not help them think while they read. Instead, guided questions that focus on skills such as developing inferences or analyzing the content should predominate. In order to help students think through more complex ideas and practice building thought-frameworks of written material, opportunities for reading and then discussing relatively long selections should be provided.

Writing and reading are so closely related that they are most effectively taught together. This instruction can also be structured so that a primary focus is on higher-order skills. For example, the process of composing can be presented to students as a way to construct and communicate their own ideas, while the process of reading comprehension helps them to reconstruct the ideas first communicated by another. Reading/writing assignments in which this theme of communication predominates provide a framework for discussion and analytic thinking.

References:

Armbruster, Anderson, and Ostertag 1987; Chall 1983; Jensen 1984; Pearson 1985; Tierney and Shanahan 1991.

6a.8. Emphasis on the Writing Process: Stressing the processes of composing (planning, drafting, revising, sharing, and publishing) contributes to improved competence in writing.

Research findings:

Extensive research on the composing processes of young people began about 25 years ago and has continued to this day. The research has helped to identify not only the various stages of writing, but also the ways in which attention to process can effectively inform classroom instruction.

Some research is also available about the effects of word processing on composition, but it is often contradictory. Aspects of writing studied included motivation toward writing, frequency of revision, and quality of writing. Results are generally small although in the positive direction.

In the classroom:

The complete process of written composition involves a series of recursive and interlocking stages, each of which should be discussed with students so they understand its value and place in the process. Composing processes may vary with individuals, but long-range improvement in writing competence depends in good measure on students' understanding of the processes in which they engage.

Frequent practice is also necessary if writing is to improve, and such practice requires devoting time to writing in class. Particularly useful are occasional double periods or writing workshops during which the teacher is free to provide guidance to individuals as they engage in the writing process. Also useful are conferences to discuss the processes with individuals or to help students apply a point made during instruction to their work.

Whole class or small group discussion that provides time for students to talk about their work and to ask for feedback from other students can also be used as a way to focus on process. For example, a student may share his/her thoughts about a possible revision from the perspective of his/her original plans for the written piece, as well as where it currently stands.

References:

Bangert-Drowns 1993; Bereiter and Scardanalia 1987; Dyson and Freedman 1991a, 1991b; Emig 1971; Freedman 1987; Graves 1983; Jensen 1993.

6a.9. Balanced Reading and Writing: Programs that provide balanced attention to both imaginative and informative reading, writing, and speaking promote competence in handling discourse of many kinds.

Research findings:

Beginning with Rosenblatt's definitive study of literary response in 1978 and the work by Britton and his associates in defining the varied modes of writing, researchers have been increasingly concerned about the need for balanced attention to the different modes of reading and writing.

Researchers agree that the writing process as generally presented in classrooms should be considered only a general guide to writing. Different types of writing require variations of the process. Thus, students engaged in producing different styles of writing learn not only new modes but different approaches to developing a finished product. Recent studies indicate that schools are failing to have students practice the skills associated with expository writing.

In the classroom:

The curriculum must help children develop competence in comprehending and composing prose of many kinds. While literary selections can engage children's interest as they begin to read, experience with factual and scientific prose is also important. Similarly, over-emphasis on personal writing to the neglect of informative or factual writing can limit students' overall growth in ability to compose.

This suggests that teachers should provide instruction in a variety of forms as well as variations of the writing process. The differences among the types of writing should be explicitly presented, and students should be given assistance while they practice. The role for the teacher in this process is an active one; extensive guidance will be needed by many students as they attempt to comprehend and demonstrate mastery of the distinctions among the many different types of writing.

Regular opportunities to engage in activities that use different modes of discourse are also important to student growth. For example, the processes involved in responding to literature differ from those used in seeking information from texts and then presenting it to others. These modes must be taught, modeled, and practiced.

References:

Britton et al. 1975; Dyson and Freedman 1991a, 1991b; Olson 1995; Probst 1988; Rosenblatt 1978; Squire 1984; Venezky et al. 1987.

6a.10. Early Intervention: Carefully designed early intervention for children who experience difficulty in learning to read and write can produce significant long-term improvement.

Research findings:

For 50 years, research has pointed to the importance of early intervention to help children who experience difficulty in learning to read and write. Today's studies warn, however, against extensively isolating children for remedial instruction, and suggest new ways in which tutoring and other support activities can be provided without permanently assigning children to "special" classrooms. The need to provide extensive opportunities to read, rather than merely drill and practice of skills in isolation, has been documented as important for students with early reading difficulties.

In the classroom:

Early intervention occurs most effectively within the total classroom with special support provided as needed. Pull-out programs that permanently isolate children in order to cater to special needs contribute less to their learning than does mainstream classroom instruction with provision for flexible grouping of students. Moreover, such mainstream grouping gives students with reading difficulties the opportunity to observe and learn from students who have moved to the next stage of development and to benefit from the social aspects of reading.

Pullout programs have often had the additional disadvantage of making less rather than more time for reading instruction available to students with reading problems. Two widely emulated programs—the Reading Recovery program developed by Marie Clay and the Success for All program of Robert Slavin—have been carefully structured to ensure that this does not happen. Both involve early diagnosis and treatment, one-to-one tutoring by certificated teachers, varied use of flexible grouping in the basic classroom, a print-rich environment with opportunities for reading, and personal instruction on word attack skills with students scheduled for special help in addition to rather than as a substitute for regular reading instruction.

Opportunities to read for meaning and to experience success with reading are as important for students having difficulty as for students without problems—perhaps even more important. To address these needs, Reading Recovery uses a series of little books, carefully selected to be both interesting and accessible, that can be read by the students in the program.

References:

Allington 1994; Cazden 1988; Indrisano and Paratore 1991; Lyons, Pinnell, and Deford 1993; Slavin and Madden 1987; Slavin et al. 1992.

6a.11. Exposure to a Range of Literature: Reading and reflecting on a range of selected literary works can help young people learn about the ideas and values of their own and diverse cultures as well as about the experiences of different groups.

Research findings:

While recent studies of the types of literary works taught in many schools agree that the school curriculum has changed over recent decades, there is no universal agreement about the extent to which it has changed or about whether the changes made are all for the better. Controversy exists about the mix taught, about possible inadequate representation of some minority groups, and about whether efforts to include material from many cultures have resulted in a decline in student knowledge about writers traditionally considered to be important. The degree of change that has actually occurred appears to vary by community.

In the classroom:

The traditional literary canon conveys many of the values on which our country is based. In addition, young people need to understand the values conveyed in the literary heritages of varied cultural groups, with this need increasingly critical because of dramatically changing demographics. Schools should develop curricular programs that contain both traditional and nontraditional literature of high quality.

Although balance in the types of literature taught is important, local communities will continue to resolve, sometimes through controversy, what will be taught locally.

References:

Applebee 1991; Cullinan 1987; Purves 1994; Ravitch and Finn 1987; Stotsky 1995.

6a.12. Appropriate Assessment: Assessment that focuses on what is being taught in a school's curriculum and on the modes of instruction used in the curriculum promotes learners' growth toward curricular goals.

Research findings:

Studies of assessment have identified a misalignment between many of the assessment instruments and approaches used and instructional goals and programs. For example, while instructional attention in the area of writing has shifted from a focus on specific skills to the processes involved in learning to write, few assessment instruments address this new emphasis. Many reading tests ignore assessment of competence in comprehending longer selections, a task that is receiving increased attention in schools.

In the classroom:

Assessments should measure what teachers teach and what students learn. Such assessments help teachers to discover what is working in the teaching-learning interaction. Too often, assessment instruments focus on content that is not central to a school's program. When school-wide, local, and especially high-stakes state assessments are unrelated to classroom instruction, students' test scores may be low, but the data generated tell little about what should be done to improve instruction. Additional classroom-based assessment may have to be conducted for this purpose.

An alternative scenario may be the one that currently exists in some states. Interest in improving higher-order skills of students is intense, and state assessments are being developed and administered that focus on these skills. In cases such as these, changes in assessment may actually precede changes in instruction and provide direction about new curricular goals.

References:

Farr 1992; Farr and Beck 1991; Geneshi 1994; Johnston 1984.

References

Adams, M. 1990. *Beginning to Read: Thinking and Learning About Print.* Cambridge, MA: The MIT Press.

Allington, R.L. 1994. "The Schools We Have, the Schools We Need." *Reading Teacher* Vol. 48, No. 1 (September 1994): 14-28.

Anderson, R.C. and D.D. Pearson. 1984. "A Schema-Theoretic View of Basic Process in Reading Comprehension." In *Handbook of Reading Research*, D. Pearsonet al., editors (pp. 255-291). New York: Longman.

Anderson, R.C., P.T. Wilson., and L.G. Fielding. 1988. "Growth in Reading and How Children Spend Their Time Outside of School." *Reading Research Quarterly* Vol. 23: 285-303.

Anderson, R.C., E.H. Hiebert, J.A. Scott, and I.A.G. Wilkinson. 1985. *Becoming a Nation of Readers.* Washington, DC: National Academy of Education.

Applebee, A.N. 1991. *A Study of High School Literary Anthologies.* Albany, NY: Literature Center, University of New York at Albany.

Armbruster, B., T. Anderson, and D. Ostertag. 1987. "Does Test Structure/Summarization Instruction Facilitate Learning from Expository Text?" *Reading Research Quarterly* Vol. 21: 331-346.

Bangert-Drowns, R.L. 1993. "The Word Processor as an Instructional Tool: A Meta-analysis of Word Processing in Writing Instruction." *Review of Educational Research* Vol. 63, No. 1 (Spring 1993): 69-93.

Bereiter, C. and M. Scardanalia. 1987. *The Psychology of Written Composition.* Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Britton, J. 1970. *Language and Learning.* Coral Gables, FL: University of Miami Press.

Britton, J., T. Burgess, T. Martin, A. McLeod, and H. Rosen. 1975. *The Development of Writing Abilities.* London and Basingstoke, England: McMillan Ltd.

Cazden, C. 1988. *Classroom Discourse: The Language of Teaching and Learning.* Portsmouth, NH: Heinemann.

Cazden, C. 1991. *Whole Language Plus.* New York: Teachers College, Columbia University.

Chall, J.S. 1967 (revised 1983). *Learning to Read: The Great Debate.* New York: McGraw-Hill Book Company.

Chall, J.S. 1983. *Stages of Reading Development.* New York: McGraw-Hill Book Company.

Chall, J.S. and V.A. Jacobs. (in progress, 1995). *The Reading, Writing, and Language Connection.* A paper prepared for a volume dedicated to Dina Feitelsen. Harvard Graduate School of Education.

Clay, M. 1991. *Becoming Literate: The Construction of Inner Control.* Portsmouth, NH: Heinemann

Cullinan, B., editor. 1987. *Children's Literature in the Reading Program.* Newark, DE: International Reading Association.

Dewey, J. 1933. *How We Think: A Restatement of the Relation of Reflective Thinking to the Educative Process (revised).* Boston, MA: D.C. Heath.

Dole, J., G. Duffy, L. Roehler, and P. Pearson. 1991. "Moving from the Old to the New: Research on Reading Comprehension Instruction." *Review of Educational Research* Vol. 61, No. 2: 239-264.

Dyson, A.H. and S.W. Freedman. 1991a. *Critical Challenges for Research on Writing and Literacy: 1990-1995.* Berkeley, CA: Center for the Study of Literacy, and Pittsburgh, PA: Center for the Study of Writing.

Dyson, A.H. and S.W. Freedman. 1991b. "Writing." In *Handbook of Research on Teaching the English Language Arts*, J. Flood, J.M. Jensen, D. Lapp, and J.R. Squire, editors (pp. 754-774). New York: Macmillan Publishing Company.

Emig, J. 1971. *The Composing Processes of Twelfth Graders.* Urbana, IL: National Council of Teachers of English.

Farr, R. 1992. "Putting It All Together: Solving the Reading Assessment Puzzle." *The Reading Teacher* Vol. 46, No. 1: 26-37.

Farr, R. and M. Beck. 1991. "Formal Methods of Evaluation." In *Handbook of Research on Teaching the English Language Arts*, J. Flood, J.M. Jensen, D. Lapp, and J.R. Squire, editors (pp. 489-501). New York: Macmillan Publishing Company.

Farrell, E.J. 1991. "Instructional Models for English Language Arts, K-12." In *Handbook of Research on Teaching the English Language Arts*, J. Flood, J. M. Jensen, D. Lapp, and J.R. Squire, editors (pp. 63-84). New York: Macmillan Publishing Company.

Fielding, L.G. and P.D. Pearson. 1994. "Reading Comprehension: What Works." *Educational Leadership* Vol. 51, No. 5: 62-68.

Flood, J. and D. Lapp. 1991. "Reading Comprehension Instruction." In *Handbook of Research on Teaching the English Language Arts*, J. Flood, J.M. Jensen, D. Lapp, and J.R. Squire, editors (pp. 732-742). New York: Macmillan Publishing Company.

Freedman, S.W. 1987. *Response to Student Writing.* Urbana, IL: National Council of Teachers of English.

Freedman, S.W. and A. McLeod. 1988. *National Surveys of Successful Teachers of Writing and Their Students.* Berkeley, CA: National Center for the Study of Writing, University of California at Berkeley.

Geneshi, C. 1994. "Assessment and Achievement Testing in the Early Grades." In *Encyclopedia of English Studies and Language Arts*, A. Purves, editor (pp. 72-76). New York: Scholastic.

Goodman, Y., W. Hood, and K. Goodman. 1991. *Organizing for Whole Language.* Portsmouth, NH: Heinemann Educational Books.

Graves, D. 1983. *Writing: Teachers and Children at Work.* Portsmouth, NH: Heinemann Educational Books.

Guthrie, J.T., W. Schafer, Y.Y. Wang, and P. Afflerbach. 1995. "Relationships of Instruction to the Amount of Reading: An Exploration of Social, Cognitive, and Instructional Connections." *Reading Research Quarterly* Vol. 30, No. 1: 8-25.

Haller, E., D. Child, and H. Walberg. 1988. "Can Comprehension Be Taught? A Quantitative Synthesis of Metacognitive Studies." *Educational Researcher* Vol 17, No. 9: 5-8.

Harste, J.C. and K.G. Short. 1988. *Creating Classrooms for Authors: The Reading-Writing Connection.* Portsmouth, NH: Heinemann Educational Books.

Hartman, D. 1995. "The Intertectual Links of Proficient Readers Reading Multiple Passages." *Reading Research Quarterly.*

Hill, M. 1991. "Writing Summaries Promotes Thinking and Learning Across the Curriculum, But Why Are They So Difficult to Write?" *Journal of Reading* Vol. 34, No. 7 (April 1991): 536-539.

Indrisiano, R. and J.R. Paratore. 1991. "Classroom Contexts for Literacy Learning." In *Handbook of Research on Teaching the English Language Arts,* J. Flood, J.M. Jensen, D. Lapp, and J.R. Squire, editors (pp. 477-488). New York: Macmillan Publishing Company.

Jensen, J., editor. 1984. *Composing and Comprehending.* Urbana, IL: National Council of Teachers of English.

Jensen, J.M. 1993. "What Do We Know About the Writing of Elementary School Children?" *Language Arts* Vol. 70: 290-294.

Johnson, D., R. Johnson, and E. Holobec. 1991. *Cooperation in the Classroom.* Edina, MN: Interaction Book Company.

Johnston, P.H. 1984. "Assessment in Reading." In *Handbook of Reading Research,* D. Pearson et al., editors (pp. 147-184). New York: Longman.

LaBrant, L. 1961. "The Uses of Communication Media." In *The Guinea Pigs Grow Up,* M. Willis, editor. Columbus, OH: Ohio State University Press.

Lyons, C.A., G.S. Pinnell, and D.E. Deford. 1993. *Partners in Learning: Teachers and Children in Reading Recovery.* New York: Teachers College Press.

Maguire, M. 1994. "Integration of Learning." In *Handbook of Research on Teaching the English Language Arts,* J. Flood, J.M. Jensen, D. Lapp, and J.R. Squire, editors (pp. 638-639). New York: Macmillan Publishing Company.

McCabe, A. and C. Peterson. 1991. *Developing Narrative Structure.* Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

McLain, K.V. 1991. "Metacognition in Reading Comprehension: What Is It and Strategies for Instruction." *Reading Improvement* Vol. 28, No. 3: 169-172.

Moffett, J. and B.J. Wagner. 1983. *Student-Centered Language Arts and Reading: A Handbook for Teachers,* 3rd edition. Boston, MA: Houghton-Mifflin.

Nagy, W.E. 1988. Teaching *Vocabulary to Improve Reading Comprehension.* Urbana, IL: National Council of Teachers of English.

Nagy, W., R. Anderson, and P. Herman. 1987. "Learning Word Meanings from Context During Normal Reading." *American Educational Research Journal* Vol. 24, No. 2: 237-270.

Olson, L. 1995. "Students' Best Writing Needs Work, Study Shows." *Education Week* Vol. 14, No. 20 (February 8, 1995): 5.

Palincsar, A.S. and A.L. Brown. 1985. "Reciprocal Teaching Activities to Promote Reading with Your Mind." In *Reading, Thinking, and Concept Development: Strategies for the Classroom,* T.L. Harris and E.J. Cooper, editors (pp. 147-159). New York: The College Board.

Paris, S.G., B.A. Wasik, and J.C. Turner. 1991. "The Development of Strategic Readers." In *Handbook of Reading Research, Volume 2,* D. Pearson et al., editors (pp. 609-640). New York: Longman.

Pearson, P.D. 1993. "Teaching and Learning Reading: A Research Perspective." *Language Arts* Vol. 70, No. 6: 502-511.

Pearson, P.D. 1985. "Changing the Face of Reading Comprehension Instruction." *The Reading Teacher* Vol. 38, No. 8: 724-738.

Piaget, J. 1959. *The Language and Thought of the Child,* 3rd edition. London: Routledge and Kegan Paul.

Pressley, M. et al. 1990. *Cognitive Strategy Instruction that Really Improves Childrens' Academic Performance.* Cambridge, MA: Brookline Books.

Probst, R. 1988. *Response and Analysis: Teaching Literature in Junior and Senior High School.* Portsmouth, NH: Heinemann.

Purves, A. 1994. "Response to Literature." In *Encyclopedia of English Studies and Language Arts,* A.C. Purves et al., editors (pp. 1043-1046). New York: Scholastic.

Purves, A.C. and R. Beach. 1972. *Literature and the Reader.* Urbana, IL: National Council of Teachers of English.

Ravitch, D. and C. Finn, Jr. 1987. *What Do Our 17-Year Olds Know? A Report on the First National Assessment of History and Literature.* New York: Harper and Row.

Rosenblatt, L.M. 1978. *The Reader, the Text, the Poem: The Transactional Theory of the Literary Work.* Carbondale, IL: Southern Illinois University.

Rosenshine, R. and B. Stevens. 1984. "Classroom Instruction in Reading." In *Handbook of Reading Research,* D. Pearson et al., editors (pp. 745-798). New York: Longman.

Shaughnessy, M.P. 1977. *Errors and Expectations: A Guide for the Teacher of Basic Writing.* New York: Oxford University Press.

Slavin, R.E. and N.A. Madden. 1987. *Effective Classroom Programs for Students At Risk.* Baltimore, MD: Center for Research on Elementary and Middle Schools, Johns Hopkins University.

Slavin, R.E., N.A. Madden, L.J. Dolan, and B.A. Wasik. 1992. *Success for All: A Relentless Approach to Prevention and Early Intervention in Elementary Schools.* Arlington, VA: Educational Research Service.

Squire, J.R. 1984. "Composing and Comprehending: Two Sides of the Same Coin." In *Composing and Comprehending,* J. Jensen, editor. Urbana, IL: National Council of Teachers of English.

Stotsky, S. 1995. "Changes in America's Secondary School Literature Programs: Good News and Bad." *Phi Delta Kappan* Vol. 76, No. 8 (April 1995): 605-612.

Strickland, R. 1962. *The Language Development of Children, Its Relationship to the Language of Reading Textbooks, and the Quality of Reading of Selected*

School Children. Bloomington, IN: School of Education, Indiana University.

Tierney, R. and J. Cunningham. 1984. "Research on Teaching Reading Comprehension." In *Handbook of Reading Research*, D. Pearson et al., editors (pp. 609-655). New York: Longman.

Tierney, R. and T. Shanahan. 1991. "Research on the Reading-Writing Relationship: Interactions, Transactions, and Outcomes." In *Handbook of Reading Research, Volume 2*, D. Pearson et al., editors (pp. 246-280). New York: Longman.

Venezky, R. et al. 1987. *The Subtle Danger: Reflections on the Literacy Abilities of America's Young Adults*. Princeton, NJ: Educational Testing Service.

Vgotsky, L.S. 1978. *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press.

Wittrock, M. 1990. "Generative Processes of Comprehension." *Educational Psychologist* Vol. 24: 345- 376.

6b. Oral Communication

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Communication is the lifeblood of society, linking people, things, places, ideas, and meaning to each other in myriad ways. It provides evidence of the human brain's ability to create meaning out of experiences—to comprehend and compose the verbal and nonverbal symbols that represent thoughts and feelings. Communication forms the basis of the human social system, for without the ability to communicate, there would be no such things as relationships, culture, or civilization.

Oral communication is fundamental to all other learning. Educators, the public, and the business community consider communication tools such as speaking skills, rhetorical strategies, and listening skills to be critical for successful participation in academic, social, and business settings. The Secretary's Commission on Achieving Necessary Skills identified oral communication skills as key elements for participation in the changing global economy.

Communication competence today requires the ability to function in a world of expanding information. Consider, for example, Rankin's classic study, cited in *Guidelines for Developing Oral Communication Curricula* (Speech Communication Association 1991), which indicates that 75 percent of the average person's day is spent communicating as a listener or as a speaker. Corporate managers report that they spend 60 percent of their days communicating orally in face-to-face contexts. A student who cannot communicate cannot learn even the most basic concepts of any other academic discipline. Those who would succeed in social, economic, or academic circumstances must be able to fully express ideas and information and to comprehend the messages around them.

Communication is a learned skill. Moreover, writing and reading skills do not automatically translate into oral or nonverbal communication and listening abilities. Listening and speaking skills are developed through exposure to well-conceived techniques and from appropriate modeling.

The lack of communicative abilities among today's students has been recognized nationally in such reports as *A Nation at Risk* (National Commission on Excellence in Education), *High School—A Report of Secondary Education in America* (Carnegie Foundation for the Advancement of Teaching), and *What Students Need to Know and Be Able to Do* (College Entrance Examination Board). Most of our schools are failing to give students the opportunity to develop their oral communication skills. Most state departments of education promote broad sets of language arts objectives that focus predominately on reading and writing. Although reading and writing are essential skills, face-to-face interaction remains the most common means of communicating, and face-to-face interaction requires speaking and listening skills. In order to ensure literacy and lifelong learning, a communicative perspective must be part of educational standards.

The Speech Communication Association's K-12 standards for listening, speaking, and media literacy, to be published in November 1995, provide an outline of the speaking and listening behaviors that students should exhibit at various grade and ability levels. The practices in this chapter discuss specific activities for teaching oral and listening competency and methods for overcoming communication apprehension for all levels of students.

The author wishes to thank Dr. Roy Berko, Director of Educational Services for the Speech Communication Association, for his assistance in the preparation of this section.

6b.1. Direct Instruction in Appropriate Pronunciation: Students who are taught how the vocal mechanism works, taught methods of pronunciation and articulation for Standard American English, and given opportunities to learn appropriate pronunciation patterns will develop awareness of the need for appropriate articulation and pronunciation and learn to fit their language to match the context of the communication situation.

Research findings:

Research shows that a speaker's voice and articulation affect the reception of his/her message by listeners. While a number of researchers and scholars have argued for the inherent value of all dialects of spoken American English, it is obvious that the Standard American English dialect is preferred for business and formal interactions. Indeed, research has shown clearly that speakers of dialects other than Standard American English are at a disadvantage in some professional and social environments. As a result, most K-12 teachers promote the use of Standard American English only or code-switching in their classrooms. Code-switching is the ability of a speaker to analyze an audience and context, and to use the dialect (whether standard or regional) most effective for the purposes of the communication interaction.

In the classroom:

Students should be given instruction in the differences in dialect, why dialects occur, and when dialects are used and should be used. An effective class discussion should generate examples of when the students themselves were judged by the way they talked. The next step is to introduce the method by which sound is produced, so that students will understand how the vocal mechanism works. When teachers teach students the functions of respiration, phonation, resonation, and articulation, the students begin to notice their own and others' use of these processes.

Students must also hear examples of Standard American English and then be given opportunities to practice those pronunciation patterns. Tape-recorded narratives and speeches can provide students with excellent examples of effective Standard American English. Moreover, students can compare examples of standard pronunciation with examples of dialects in order to distinguish similarities and differences. After students hear examples of other speakers, it is often a good time to tape record the students as they read sample passages so that they can hear their own speech patterns.

Teachers can use many different activities to allow students to practice standard pronunciation. Students can practice oral reading of poetry, newspaper articles, and excerpts from short stories or novels. Tongue twisters can be added as students progress in their effective replication of standard pronunciation. Finally, students can create their own dramas and comedies in which they role-play situations using both dialects and Standard American English.

References:

Anderson 1977; Berko, Bostwick, and Miller 1989; Berko, Wolvin, and Wolvin 1995; Crannell 1987; Devito, Giattino, and Schon 1975; Dreher and Gervase 1976; Eisenson 1985; Fairbanks 1960; Fisher 1975; Galvin, Cooper, and Gordon 1988; Glenn, Glenn, and Forman 1993; Hopper and Naremore 1978; King and DiMichael 1991; Lessac 1967; Mayer 1988; Modisett and Luter 1988; Sarnoff 1971; Wilder 1956; Williams, Hopper, and Natgalicio 1977.

6b.2. Listening Improvement Activities: Students who are provided with instruction in listening skills and opportunities to practice listening demonstrate improvement in listening as well as in speaking, reading, and learning.

Research findings:

The field of listening research is still in its infancy. As a result, there is little consensus regarding a definition of listening, the reliability of standard listening tests, or the effectiveness of popular listening instruction strategies. However, several studies support the importance of listening in the communication and learning processes. Moreover, numerous studies indicate that most students do not listen well and would benefit from instruction in listening. The research shows that since listening is a fundamental communication skill, improvement in it also results in improved behaviors in speaking, reading, and learning.

In the classroom:

There are a number of commonly used techniques for teaching listening in a classroom setting. First, teachers are encouraged to model good listening behaviors consistently. Once shown an effective example of a desired listening practice, students are better able to adopt the behavior to their own use.

Teachers should direct students' attention to the importance of listening. Significant facts about listening and examples of costly listening errors can be found in various sources, including *Teaching Effective Listening: A Practical Guide for the High School Classroom* (Coakley 1993) and *Understanding and Developing the Skills of Oral Communication: Speaking and Listening* (Hunsaker 1990).

Teachers should assess their students' listening behaviors, using a standard or teacher-created measurement. Or, they might have students assess their own listening behavior through a survey or diary. This practice should provide both students and teachers with some evidence of improvement in listening as a result of instruction and practice.

Next, teachers should inform students of the steps in the listening process. Students should learn about listening barriers and be provided with methods to overcome or manage such barriers. After students have learned the details of the listening process, teachers should provide students with a list of ways to improve listening skills. Many different lists exist. Students could generate their own lists of ways to improve their listening skills. One common list of suggestions is:

- resist distractions;
- find areas of interest;
- stay alert;
- identify the speaker's purpose and adapt to it;
- listen for themes, not facts;
- plan to report the content of the message to someone else within eight hours;
- develop notetaking skills; and
- take responsibility for the success of the communication interaction.

Finally, students should have opportunities to practice listening to various types of information, including numbers, organization and order, main idea, facts, and implied ideas. Teachers can easily present text selections orally to provide students with both content-specific information and practice in listening. In addition, students should be given opportunities to practice overcoming various listening barriers. Teachers can help students listen to classroom information more effectively by teaching students with pre-listening strategies and cues. Just as a list of objectives at the beginning of a written text chapter provides students with clues about what to look for while they are reading, a pre-listening guide can help students focus on the important points in a lecture or other oral presentation.

References:

Adler 1983; Barker 1988; Berko, Bostwick, and Miller 1989; Brown 1987; Coakley 1993; Coakley and Wolvin 1989; Cooper 1985; Fitch-Hauser and Hughes 1992; Galvin and Book 1990; Galvin, Cooper, and Gordon 1988; Gilbert 1988; Goodlad 1983; Hunsaker 1990; O'Hair, O'Hair, and Wooden 1988; Roach and Wyatt 1988; Steil 1980; Swanson 1993; West 1983.

6b.3. Activities to Improve Oral Communication Competence: Students who are given instruction in public speaking skills, opportunities to prepare for and practice language in various forms of oral discourse, perceptual feedback, and opportunities to evaluate others' messages demonstrate improvement in their speaking presentation, as well as in vocabulary, organization, and writing skills.

Research findings:

Research shows that students frequently do not build firmly established foundations in communication based on effective "coding" skills such as vocabulary use, sentence formation, understanding of grammatical conventions, and organizational cohesiveness. Language learning that emphasizes these "coding" skills helps students to improve their vocabulary, organization, and presentation skills.

Students also need direct instruction in the public speaking process. Studies have found that the following practices tend to result in improvement in speaking skills: 1) giving students the opportunity to prepare for and practice formal speeches; 2) encouraging students to prepare visual aids for their speeches; and 3) allowing students to rehearse out loud or silently.

Moreover, research indicates that students who are taught the basic orders of idea development (for example, chronological, spatial, topical, problem/solution, cause/effect, comparison/contrast) can better illustrate organizational skills in a prepared and delivered speech.

In the classroom:

Teachers can help students improve their public speaking skills by providing large amounts of time to practice and use their speaking skills, feedback on their use of public speaking skills, and instruction in evaluating the speaking skills of others.

To improve students' coding skills, teachers can use sentence-combining activities in which students are presented with two or more short sentences and encouraged to create longer sentences that include all pertinent information. The emphasis is not on the rules of syntax; in fact, research shows that this instructional method is most effective when not accompanied by grammar instruction. Instead, students evaluate the quality of different combinations according to different speaking needs.

Other instructional activities for improving students' speaking skills include variations of reconstructing experience, such as role-plays and interviews, as well as small-group interaction, classroom discussion, and other types of classroom talk.

References:

Boyd and Renz 1985; Buerkel-Rothfuss, Gray, and Yerby 1993; Burleson 1987; Clinton 1992; Fryar 1981; Galvin, Cooper, and Gordon 1988; Maratsos 1973; Menig-Peterson 1975; Menzel and Carrell 1994; Reisch and Ballard-Reisch 1985; Robinson and Robinson 1983; Rubin and Kantor 1984; Shatz and Gelman 1973; Sonnenschein and Whitehurst 1984; Whitehurst and Sonnenschein 1985.

6b.4. Activities to Reduce Oral Communication Anxiety: Students who are provided with experiences to help overcome anxiety about oral communication demonstrate improved coherence and confidence when giving a speech and in other oral communication situations.

Research findings:

It is commonly understood that many people, including students, experience some degree of anxiety regarding oral communication; yet, teachers often ignore this anxiety and forget that students who experience anxiety tend to perform poorly in oral communication tasks. Most treatments of oral communication anxiety are designed for individual or small-group sessions that occur over an extended period of time. Many, however, can be modified for use in a classroom setting and can be used in conjunction with content instruction.

In the classroom:

Since much activity in classroom instruction is communicated orally through discussions, question-and-answer sessions, and presentations, the effective classroom teacher should implement strategies to minimize students' oral communication anxiety so that the students can perform to the best of their abilities. In an ideal situation, the teacher could identify the communication problem and send the student to a specialist for specific treatment of the problem. This, however, is rarely an option. Instead, the problem frequently must be handled within the classroom and solved while the teacher is attempting to meet other instructional goals.

There are a number of specific approaches that can be used in the classroom to reduce communication anxiety:

- *Visualization* is used prior to the oral communication activity that is causing anxiety. Students are encouraged to think positively about all aspects of the communication act, from the moment the student gets up in the morning of the presentation until after the presentation has been completed. Visualization, which can be used in normal classroom settings and does not require special arrangements for training or application, reduces communication apprehension over both short and extended periods of time.
- *Systematic desensitization* is widely used in the field of communication to treat oral communication anxiety. Students who experience anxiety are led to a state of deep muscular relaxation. While in this relaxed state, they are guided with questions to visualize participating in a series of communication situations that range from the least to the most anxiety-provoking.
- *Cognitive restructuring* is based on the premise that students have irrational thoughts about themselves and their behaviors that increase their anxiety about communicating with others. Students are encouraged to identify irrational beliefs they have about communication. The teacher and students then attempt to logically refute these beliefs in an attempt to change the students' ways of thinking. Finally, the teacher helps the students formulate new, more appropriate beliefs to replace their illogical beliefs.
- *Instructional intervention* is based on the teacher's ability to manipulate the situational variables of context, motivation, and acquaintance. Oral communication anxiety tends to increase in direct proportion to the formality and importance of the student's role in the communication situation; therefore, the teacher can reduce anxiety by decreasing the formality of the situation. Students also appear more

willing to tolerate certain degrees of communication anxiety if there is ample motivation to do so, such as greater grade emphasis or greater perceived legitimacy of the communication situation. In addition, students communicate with less anxiety when they speak with friends than with strangers; therefore, the teacher can reduce anxiety by increasing the amount of familiarity between students in the class or group with whom the students will be participating.

- *Skills training* is most effective in reducing oral communication anxiety when the student is willing to participate. It assumes that anxiety can be a result of ambiguity or lack of knowledge; thus, any instruction in how to communicate automatically decreases the amount of apprehension or anxiety a student feels about communicating. An effective skills training program allows the apprehensive student to identify specific deficiencies, establish goals, observe models of the desirable skill, practice the new skills in a controlled, nonthreatening environment, and then practice the new skills in a natural environment.

  Skills training can address verbal as well as nonverbal communication behaviors. Students who are reticent often display nonverbal behaviors that others may interpret as detachment and submissiveness. Teachers can counteract this by informing their communication-reticent students that their behavior is not markedly different from that of other students, and encouraging them to increase eye contact and speaking tempo and to improve their facial expressions.

References:

Ayres and Hopf 1985, 1990; Booth-Butterfield 1988; Brownell and Katula 1984; Burgoon et al. 1987; Hopf et al. 1995; Kelly, Duran, and Stewart 1990; Motley and Molloy 1994; Neer and Kircher 1990; Richmond and McCroskey 1995; Vicker 1982; Watson 1986.

References

Adler, M.J. 1983. *How to Speak, How to Listen.* New York: Macmillan.

Anderson, V.A. 1977. *Training the Speaking Voice* (3rd edition). London: Oxford University.

Ayres, J. and T.S. Hopf. 1985. "Visualization: A Means of Reducing Speech Anxiety." *Communication Education* Vol. 34: 318-323.

Ayres, J. and T.S. Hopf. 1990. "The Long-Term Effect of Visualization in the Classroom: A Brief Research Report." *Communication Education* Vol. 39: 75-78.

Barker, L.L. 1988. *Listening Skills: Objectives and Criterion References Exercises for Grades K-12.* Auburn, AL: Spectra.

Berko, R., F. Bostwick, and M. Miller. 1989. *Basically Communicating: An Activity Approach* (2nd edition). Dubuque, IA: Wm. C. Brown.

Berko, R., A. Wolvin, and D. Wolvin. 1995. *Communicating: A Social and Career Focus* (6th edition). Boston, MA: Houghton Mifflin.

Booth-Butterfield, S. 1988. "Instructional Interventions for Reducing Situational Anxiety and Avoidance." *Communication Education* Vol. 37: 214-223.

Boyd, S. and M.A. Renz. 1985. *Organization and Outlining: A Workbook for Students in a Basic Speech Course.* Indianapolis, IN: Bobbs-Merrill.

Brown, J.I. 1987. "Listening—Ubiquitous, Yet Obscure." *Journal of the International Listening Association* Vol. 1: 3-14.

Brownell, W.W. and R.A. Katula. 1984. "The Communication Anxiety Graph: A Classroom Tool for Managing Speech Anxiety." *Communication Quarterly* Vol. 32: 243-249.

Buerkel-Rothfuss, N.L., P.I. Gray, and J. Yerby. 1993. "Meta-Analysis Between Communication Apprehension and Cognitive Performance." *Communication Education* Vol. 41: 68-76.

Burgoon, J.K., M. Pfau, T. Birk, and V. Manusov. 1987. "Nonverbal Communication Performance and Perceptions Associated with Reticence: Replications and Classroom Implications." *Communication Education* Vol. 36: 119-130.

Burleson, B.R. 1987. "Cognitive Complexity." In *Personality and Interpersonal Communication*, J.C. McCroskey and J.A. Daly, editors (pp. 305-349). Newbury Park, CA: Sage.

Clinton, B.L. 1992. "Informative Communication Instruction: An Application of Theory and Research to the Elementary School Classroom." *Communication Education* Vol. 41: 54-67.

Coakley, C.G. 1993. *Teaching Effective Listening: A Practical Guide for the High School Classroom.* New Orleans, LA: Spectra.

Coakley, C.G. and A. Wolvin, editors. 1989. *Experiential Training: Tools for Teachers and Trainers.* New Orleans, LA: Spectra.

Cooper, P.J. 1985. *Activities for Teaching Speaking and Listening: Grades 7-12.* Urbana, IL: ERIC/SCA.

Crannell, K.C. 1987. *Voice and Articulation.* Belmont, CA: Wadsworth.

Devito, J.A., J. Giattino, and T.D. Schon. 1975. *Articulation and Voice: Effective Communication.* Indianapolis, IN: Bobbs-Merrill.

Dreher, B.B. and C.J. Gervase. 1976. *Phonetics: Instruction Aid in Language Arts.* Dubuque, IA: Wm. C. Brown.

Eisenson, J. 1985. *Voice and Diction: A Program for Improvement* (5th edition). New York: Macmillan.

Fairbanks, G. 1960. *Voice and Articulation Drillbook* (2nd edition). New York: Harper.

Fisher, H. 1975. *Improving Voice and Articulation* (2nd edition). Boston, MA: Houghton-Mifflin.

Fitch-Hauser, M. and M.A. Hughes. 1992. "The Conceptualization and Measurement of Listening." *Journal of the International Listening Association* Vol. 6: 6-22.

Fryar, M. 1981. *Coaching for Individual Events.* Paper presented at the annual meeting of the Southern Speech Communication Association, Austin, TX.

Galvin, K., P. Cooper, and J.M. Gordon. 1988. *The Basics of Speech.* Lincolnwood, IL: National Textbook.

Galvin, K. and C. Book. 1990. *Person to Person.* Lincolnwood, IL: National Textbook.

Gilbert, M.B. 1988. "Listening in School: I Know You Can Hear Me—But Are You Listening?" *Journal of the International Listening Association* Vol. 2: 121-132.

Glenn, E.C., P.J. Glenn, and S. Forman. 1993. *Your Voice and Articulation* (3rd edition). Englewood Cliffs, NJ: Prentice Hall.

Goodlad, J. 1983. "A Study of Schooling: Some Findings and Hypotheses." *Phi Delta Kappan* Vol. 64, No. 7 (March 1983): 465-470.

Hopf, T., F. Ayres, T. Ayres, and B. Baker. 1995. "Does Self-Help Material Work? Testing a Manual Designed to Help Trainers Construct Public Speaking Apprehension Reduction Workshops." *Communication Research Reports* Vol. 12: 34-38.

Hopper, R. and R.J. Naremore. 1978. *Children's Speech: A Practical Introduction to Communication Development* (2nd edition). New York: Harper Collins.

Hunsaker, R.A. 1990. *Understanding and Developing the Skills of Oral Communication: Speaking and Listening* (2nd edition). Englewood, CO: Morton.

Kelly, L., R.L. Duran, and J. Stewart. 1990. "Rhetoritherapy Revisited: A Test of Its Effectiveness as a Treatment for Communication Problems." *Communication Education* Vol. 39: 207-226.

King, R.K. and E.M. DiMichael. 1991. *Voice and Diction Handbook.* Prospect Heights, IL: Waveland.

Lessac, A. 1967. *The Use and Training of the Human Voice* (2nd edition). Mountain View, CA: Mayfield.

Maratsos, M.P. 1973. "Nonegocentric Communication Abilities in Preschool Children." *Child Development* Vol. 44: 697-700.

Mayer, L.V. 1988. *Fundamentals of Voice and Diction* (8th edition). Dubuque, IA: Wm. C. Brown.

Menig-Peterson, C.L. 1975. "The Modification of Communication Behavior in Preschool-Aged Children as a Function of the Listener's Perspective." *Child Development* Vol. 46: 1015-1018.

Menzel, K.E. and L.J. Carrell. 1994. "The Relationship Between Preparation and Performance in Public Speaking." *Communication Education* Vol. 43: 17-26.

Modisett, N.F. and J.G. Luter. 1988. *Speaking Clearly: The Basics of Voice and Articulation* (3rd edition). Edina, MN: Burgess.

Motley, M.T. and J.L. Molloy. 1994. "An Efficacy Test of a New Therapy ('Communication-Orientation Motivation') for Public Speaking Anxiety." *Journal of Applied Communication Research* Vol. 22: 48-58.

Neer, M.R. and W.F. Kircher. 1990. *Classroom Interventions for Reducing Public Speaking Anxiety.* Paper presented at the Speech Communication Association 76th Annual Meeting, Chicago, IL.

O'Hair, M., D. O'Hair, and S.L. Wooden. 1988. "Enhancement of Listening Skills as a Prerequisite to Improved Study Skills." *Journal of International Listening Association* Vol. 2: 113-120.

Reisch, R.J. and D.S. Ballard-Reisch. 1985. *Coaching Strategies in Contest Persuasive Speaking: A Guide to Coaching the Novice.* Paper presented at the annual meeting of the Speech Communication Association, Denver, CO.

Richmond, V.P. and J.C. McCroskey. 1995. *Communication: Apprehension, Avoidance, and Effectiveness.* Scottsdale, AZ: Gorsuch, Scarisbrick.

Roach, C. and N.J. Wyatt. 1988. *Successful Listening.* New York: Harper & Row.

Robinson, E.J. and W.P. Robinson. 1983. "Communication and Meta-Communication: Quality of Children's Instructions in Relation to Judgments About the Adequacy of Instructions and the Locus of Responsibility for Communication Failure." *Journal of Experimental Child Psychology* Vol. 35: 305-320.

Rubin, D.L. and K.J. Kantor. 1984. "Talking and Writing: Building Communication Competence." In *Speaking and Writing K-12*, C. Thaiss and C. Suhor, editors (pp. 29-73). Urbana, IL: National Council of Teachers of English.

Sarnoff, D. 1971. *Speech Can Change Your Life.* New York: Dell.

Shatz, M. and R. Gelman. 1973. "The Development of Communication Skills: Modifications in the Speech of Young Children as a Function of Listener." *Monographs of the Society for Research in Child Development* Vol. 38 (5, Serial No. 152).

Sonnenschein, S. and G.J. Whitehurst. 1984. "Developing Referential Communication: A Hierarchy of Skills." *Child Development* Vol. 48: 993-1001.

Speech Communication Association. 1991. *Guidelines for Developing Oral Communication Curricula in Kindergarten Through Twelfth Grade.* Annandale, VA: Author.

Steil, L.K. May 26, 1980. "Secrets of Being a Better Listener." *U.S. News & World Report*, pp. 65-67.

Swanson, C.H. 1993. "Empower Your Teaching by Meeting Your Listeners' Needs." *Journal of the International Listening Association* (Special issue): 17-26.

Vicker, L.A. 1982. *The Speech Anxiety Reduction Program: Implementation of a Large-Scale Program for Reducing Fear of Public Speaking.* Paper presented at the annual convention of the Eastern Communication Association, Hartford, CT.

Watson, A.K. 1986. *Communication Apprehension: Alleviation Through a Semester Basic Speech Course.* Paper presented at the annual convention of the Eastern Communication Association, Atlantic City, NJ.

West, B.F. 1983. "The Most Used Communication Method Receives the Least Instruction Time." *Listening Post Supplement:* 3-19.

Whitehurst, G.J. and S. Sonnenschein. 1985. "The Development of Communication: A Functional Analysis." In *Annals of Child Development, 2*, G.J. Whitehurst, editor (pp. 1-48). Greenwich, CT: JAI.

Wilder, L. 1956. *Professionally Speaking.* New York: Simon & Schuster.

Williams, F., R. Hopper, and D.S. Natgalicio. 1977. *The Sounds of Children.* Englewood Cliffs, NJ: Prentice Hall.

Chapter 7. Mathematics

Douglas A. Grouws

The number of research studies conducted in mathematics education over the past three decades has increased dramatically (Kilpatrick 1992). The resulting research base spans a broad range of content, grade levels, and research methodologies. The results from these studies, along with relevant findings from research in other domains, such as cognitive psychology, are used to identify the successful teaching strategies and practices described in this chapter.

Teaching and learning mathematics are complex tasks. The effect on student learning of changing a single teaching practice may be difficult to discern because of the simultaneous effects of both the other teaching activities that surround it and the context in which the teaching takes place.

Thus, as teachers seek to improve their teaching effectiveness by changing their instructional practices, they should carefully consider the teaching context, giving special consideration to the types of students they teach. And, further, they should not judge the results of their new practices too quickly. Judgments about the appropriateness of their decisions must be based on more than a single outcome. If the results are not completely satisfactory, then teachers should consider whether circumstances may be diminishing the impact of the practices they are implementing. For example, the value of a teacher focusing more attention on teaching for meaning may not be demonstrated if student assessments concentrate on rote recall of facts and proficient use of isolated skills.

The quality of the implementation of a teaching practice also greatly influences its impact on student learning. The value of using manipulative materials to investigate a concept, for example, depends not only on *whether* manipulatives are used, but on *how* they are used with the students. Similarly, small-group instruction will benefit students only if the teacher knows when and how to use this teaching practice. Hence, as a teacher implements any of the recommendations in this chapter, it is essential that he or she constantly monitor and adjust the way the practice is implemented to optimize improvements in quality.

These cautions not withstanding, the research findings indicate that certain teaching strategies and methods are worth careful consideration as teachers strive to improve their mathematics teaching practices. As readers examine the suggestions that follow, it will become clear that many of the practices are interrelated. There is also considerable variety in the practices that have been found to be effective, so most teachers should be able to identify things they would like to try in their classrooms. The practices are not mutually exclusive; indeed, they tend to be complementary. The logical consistency and variety in the suggestions from research make them both interesting and practical.

7.1. Focus on Meaning: Focusing instruction on the meaningful development of important mathematical ideas increases student learning.

Research findings:

There is a long history of research on the effects of teaching for meaning and understanding in mathematics going back to the 1940s and the work of William Brownell. Investigations have consistently shown that an emphasis on teaching for meaning has positive effects on student learning, including better initial learning, greater retention, and increased likelihood that the ideas will be used in new situations. These results have also been found in studies conducted in classrooms in high-poverty-areas.

In the classroom:

As might be expected, the way "teaching for meaning" has been conceptualized has varied somewhat from study to study and the concept has evolved over time. Teachers will want to consider how various interpretations of this concept can be incorporated into their classroom practice. These variations include:

- *Emphasis on the mathematical meanings of ideas, including how the idea, concept, or skill is connected in multiple ways to other mathematical entities in a logically consistent and sensible manner.* Thus, for subtraction, the inverse, or "undoing," relationship between it and addition is emphasized. Careful development of the relationship between fractions and decimals as two ways to name rational numbers is another example. In general, this emphasis was common in early research in this area in the late 1930s. Its purpose was to ensure that the mathematical meaningfulness of the ideas taught was not relegated to minor attention due to the heavy emphasis on the social uses and utility of mathematics in everyday life that was prevalent at the time.
- *Focus on the critical role of the classroom learning context in which students construct their meanings.* Some research indicates that the closer the learning context is to real-life situations with which students identify, the more likely it is that they will be able to use the newly learned idea. This suggests that the level of abstraction of a learning environment must be carefully regulated, closely monitored, and thoughtfully chosen in consideration of student backgrounds and interests. This does *not* mean, however, that every learning context must be grounded in a real-life situation, nor that abstract settings are always inappropriate.
- *Emphasis on making explicit the connections between different subject-matter areas, such as mathematics and science.*

References:

Brownell 1945, 1947; Good, Grouws, and Ebmeier 1983; Hiebert and Carpenter 1992; Knapp, Shields, and Turnbull 1995; Koehler and Grouws 1992; Lave 1988; Skemp 1978.

7.2. Student Use of Calculators: Using calculators in the learning of mathematics can result in increased achievement and improved student attitudes.

Research findings:

The impact of calculator use on student learning has been a popular research area in mathematics education. Many studies have shown that calculator use improves student achievement and attitudes.

From a meta-analysis of 79 non-graphing calculator studies, Hembree and Dessart concluded that the use of hand-held calculators improved student learning. In particular, they found improvement in students' understanding of arithmetical concepts and in their problem-solving skills. Their analysis also showed that students using calculators tended to have better attitudes toward mathematics and much better self-concepts in mathematics than did their counterparts who did not use calculators.

Data from the National Assessment of Educational Progress demonstrated that students who frequently used calculators showed the highest mathematics achievement.

The research base on the use of scientific calculators with graphing capabilities is still developing and the results are more mixed than the findings from the studies of non-graphing calculators. Whereas most studies have found positive effects on overall student achievement from graphics calculator use, some studies have found no differences between comparison classes, and one study favored the control group that did not use calculators. Moreover, it is difficult to sort out the effects of the presence of calculators from curriculum effects, because the calculator's very presence changes both the intended curriculum and the curriculum that is actually received by the students. In spite of these difficulties, and as Dunham and Dick concluded from their survey of the graphing calculator research, the evidence in the areas of students' understanding of function and graphing concepts, students' problem solving, and classroom dynamics certainly suggests that graphing calculator technology can be a catalyst for mathematics learning.

In the classroom:

Research strongly supports the call of the National Council of Teachers of Mathematics in its *Curriculum and Evaluation Standards for School Mathematics* for the use of calculators at all levels of mathematics instruction. Using calculators in carefully planned ways can result in increases in student problem-solving ability and improved affective outcomes, without a loss in "basic skills."

Further, in order to accurately reflect students' meaningful mathematics performance, students should be allowed to use their calculators on achievement tests. Not to do so is a major disruption of many students' usual way of doing mathematics, and an unrealistic restriction because when they are away from the school setting they will certainly use a calculator in their work places. Another factor that argues for calculator use is that the Advanced Placement Calculus examination of the College Board now requires the use of a graphics calculator.

References:

Davis 1990; Dunham and Dick 1994; Flores and McLeod 1990; Giamati 1991; Harvey 1993; Hembree and Dessart 1986, 1992; Mullis, Jenkins, and Johnson 1994; National Council of Teachers of Mathematics 1989; Rich 1991; Ruthven 1990.

7.3. Small-Group Learning: Using small groups of students to work on activities, problems, and assignments can increase student mathematics achievement.

Research findings:

There is considerable research evidence within mathematics which indicates that using small groups for classroom tasks has positive effects on student learning. Davidson, for example, reviewed almost 80 studies in mathematics that compared student achievement in small-group settings with traditional whole-class instruction. In more than 40 percent of these studies, students in the classes using small-group approaches significantly outscored control students on measures of student performance. In only two of the 79 studies did control group students perform better than the small-group students, and in these studies there were some design irregularities.

From a review of 68 studies of cooperative group learning methods at the elementary and secondary school levels, Slavin concluded that cooperative methods were effective in improving student achievement. The most effective methods emphasized both group goals and individual accountability.

In a review of studies that examined peer interaction and achievement in small groups (17 studies, grades 2-11), Webb found two consistent results. First, giving explanations of an idea, method, or solution to a teammate in a group situation was positively related to achievement. Second, receiving "non-responsive" feedback (no feedback or feedback that is not pertinent to what one has said or done) from teammates was negatively related to achievement.

Qualitative investigations have shown that other important and often unmeasured outcomes beyond improved general achievement can result from small-group work. In one such investigation, Yackel, Cobb, and Wood studied a second-grade classroom in which small-group problem solving followed by whole-class discussion was the primary instructional strategy for the entire school year. They found that this approach created many learning opportunities that do not typically occur in traditional classrooms, including opportunities for collaborative dialogue and resolution of conflicting points of view.

In the classroom:

Research findings clearly support the use of small groups as part of mathematics instruction. This approach can result in increased student learning as measured by traditional achievement measures as well as other important outcomes, such as improvement in student ability to communicate, resolve differences, and get along with others.

In using small groups for mathematics instruction, teachers should strive to:

- choose appropriate tasks that deal with important mathematical concepts and ideas;
- give clear instructions to the groups and set clear expectations for each group;
- emphasize both group goals and individual accountability—for example, by indicating that an individual from each group will report for the group, but withholding the name of the individual until group work has been completed.

Finally, as several research studies have shown, teachers should not think of small groups as something that must always be used or never be used. Rather, small-group instruction should be thought of as an instructional practice that is appropriate for certain learning objectives, and as a practice that can work well with other organizational arrangements including whole-class instruction.

References:

Davidson 1985; Slavin 1990a, 1990b; Webb 1991; Yackel, Cobb, and Wood 1991.

7.4. Opportunity to Learn: The extent of students' opportunity to learn mathematics content bears directly and decisively on student mathematics achievement.

Research findings:

The term "opportunity to learn" (OTL) refers to the scope of the mathematics taught to students in a mathematics class. The concept was studied in the First International Mathematics Study (Husén 1967), where it was measured using a questionnaire that asked teachers to rate the extent of student exposure to particular mathematical concepts and skills. Strong correlations were found between student OTL scores and mean student achievement scores in mathematics, with high OTL scores associated with high achievement. McKnight and others reported that OTL was also strongly related to student mathematics achievement in the Second International Mathematics Study (SIMS).

Within the U.S. data from the SIMS, important differences were found in the proportion of students taught mathematical topics in different mathematics classes or tracks at grade 8. For example, students in remedial classes, typical grade 8 classes, and pre-algebra classes were exposed to very different mathematics content, and their achievement levels varied accordingly.

The importance of student opportunity to learn is also attested to by the strong relationship between mathematics course taking at the secondary school level and student achievement. Reports from the 1992 National Assessment of Educational Progress (NAEP) in mathematics showed that "the number of advanced mathematics courses taken was the most powerful predictor of students' mathematics performance after adjusting for variations in home background." Textbooks are also related to student OTL because many textbooks do not contain much content that is new to the students. The lack of attention to new material in many textbooks is of particular concern at the elementary school level. Flanders examined several textbook series and found that less than 50 percent of the pages in textbooks at grades 2 through 8 contained any material new to students.

As might be expected, there is also a positive relationship between total time allocated to mathematics and general mathematics achievement. Keeves, for example, found a significant relationship across Australian states between achievement in mathematics and total curriculum time spent on learning mathematics.

International comparisons at the elementary school level show that American students in general receive much less instruction in mathematics than do their age cohorts in other countries. Stevenson, Lee, and Stigler, in a study of Chinese, Japanese, and U.S. elementary school students at grades K, 1, and 5, found that U.S. students received far less instructional time in mathematics, and their achievement levels were substantially lower than the children from the other two countries.

The achievement tests used in international studies and in NAEP assessments measure important mathematical outcomes and have commonly provided a broad and representative coverage of mathematics. Moreover, the tests have generally served to measure what even the most able students know and do not know.

In the classroom:

The findings about the relationship between opportunity to learn and student achievement have important implications for teachers. In particular, it seems prudent at every grade level to ensure that sufficient time is allocated for mathematics instruction. Short class periods in mathematics, instituted for whatever practical or philosophical reason, should be seriously questioned. Of special concern are the 30-40 minute class periods for mathematics being implemented in some middle school settings. Although there certainly is a point of diminishing return when adding more class time for mathematics, given current levels of allocation in the U.S., this is not a problem that American teachers will need to be concerned with in the near future.

Textbooks that devote major attention to review and address little new content each year should be avoided, or their use should be compensated for in appropriate ways. Teachers should not hesitate to use textbooks as one instructional tool among many to meet important mathematical objectives, rather than feel dutifully bound to go through the textbook on a one-section-per-day basis.

It is important to note that opportunity to learn is related to questions of equity. Low-achieving and remedial students in mathematics are often tracked into special "basic skills" curricula, which are generally oriented towards computation with little opportunity to learn problem solving and higher-order thinking. The impoverished curriculum provided to some students is an especially serious problem because the skills that are frequently untaught or de-emphasized are the very ones needed in everyday life and in the workplace.

References:

Flanders 1987; Husén 1967; Keeves 1976, 1994; McKnight et al. 1987; Mullis, Jenkins, and Johnson 1994; Stevenson, Lee, and Stigler 1986.

7.5. Number Sense: Teaching mathematics with a focus on number sense encourages students to become problem solvers in a wide variety of situations and to view mathematics as a discipline where thinking is important.

Research findings:

"Number sense" is a construct that relates to having an intuitive feel for number size and combinations as well as the ability to flexibly work with numbers in problem situations in order to make sound decisions and reasonable judgments. Number sense involves being able to flexibly use the processes of mentally computing, estimating, sensing number magnitudes, moving between representation systems for numbers, and judging the reasonableness of numerical results.

Markovits and Sowder studied seventh-grade classrooms in which special units on number magnitude, mental computation, and computational estimation were taught. From individual interviews, they determined that after this special instruction students were more likely to use strategies that reflected sound number sense, and that this was a long-lasting change.

Other important research in this area involves the integration of the development of number sense with the teaching of other mathematical topics, as opposed to teaching separate lessons on aspects of number sense. In a study of second graders, Cobb and his colleagues found that students' number sense was improved as a result of a problem-centered curriculum that emphasized student interaction and self-generated solution methods. Almost every student developed a variety of strategies to solve a wide range of problems. Students also demonstrated other desirable affective outcomes, such as increased persistence in solving problems.

Kamii worked with primary grade teachers as they attempted to implement an instructional approach rooted in a constructivist theory of learning based on the work of Piaget. Central to the instructional approach was providing situations for students to develop their own meanings, methods, and number sense. Interview data with students showed that the treatment group demonstrated greater autonomy, conceptual understanding of place value, and ability to do estimation and mental computation than did students in comparison classrooms.

In the classroom:

Competence in the many aspects of number sense is an important mathematical outcome for students. Over 90 percent of the computation done outside the classroom is done without pencil and paper using mental computation, estimation, or a calculator. Yet in many classrooms efforts to instill number sense are given insufficient attention.

As teachers develop strategies to teach number sense, they should strongly consider moving beyond a unit-skills approach, that is, a focus on single skills in isolation, to a more integrated approach that encourages the development of number sense in all classroom activities, from the development of computational procedures to mathematical problem solving. Although more research is needed, an integrated approach to number sense will likely result not only in greater number sense but in other equally important outcomes as well.

References:

Cobb et al. 1991; Greeno 1991; Kamii 1985, 1989; Markovits and Sowder 1994; Reys et al. 1991; Reys and Barger 1994; Sowder 1992a, 1992b.

7.6. Concrete Materials: Long-term use of concrete materials is positively related to increases in student mathematics achievement and improved attitudes toward mathematics.

Research findings:

There are many studies that show that the use of concrete materials can be effective in producing understanding and meaningful use of notational systems and in increasing student concept development in general. In a comprehensive review of activity-based learning in mathematics at grades K-8, Suydam and Higgins in 1977 concluded that using manipulative materials produced greater achievement gains than not using them. In a more recent report of a meta-analysis of 60 studies (grades K through post-secondary) comparing the effects of using concrete materials with the effects of more abstract instruction, Sowell concluded that the long-term use of concrete instructional materials by teachers knowledgeable in their use increased student achievement and improved student attitudes toward mathematics.

In spite of generally positive results, there are some inconsistencies in the research findings. As Thompson points out, the research results on concrete materials do vary, even among treatments that were closely controlled and monitored and that involved the same concrete materials. For example, the use of base-ten blocks, in studies by Resnick and Omanson and by Labinowicz, showed little impact on children's learning. In contrast, studies by Fuson and Briars and by Hiebert and Wearne reported positive results from the use of base-ten blocks. The value of conceptually based instruction when using base-ten blocks was demonstrated in a more recent study by Hiebert and Wearne, who found important learning gains at the first-grade level.

The differences in results among these studies may be due to the ways the students' used the concrete materials and the ways the materials were related to notation and numerical values. The results may also be due to different orientations in the studies with regard to the role of computational algorithms and how they should be developed in the classroom. In general, however, the ambiguities in some of the research findings do not undermine the general consensus that concrete materials are valuable instructional tools.

In the classroom:

Although successful teaching requires teachers to carefully choose their procedures based on the context in which they will be used, available research results suggest teachers should more regularly use manipulative materials in mathematics instruction in order to give students hands-on experience that helps them construct useful meanings for the mathematical ideas they are learning. It is essential that children use the materials to develop their own ideas rather than using the materials in a rigid and prescribed way that focuses on remembering rather than thinking. Thus, as Thompson says, "before students can make productive use of concrete materials, they must first be committed to making sense of their activities and be committed to expressing their sense in meaningful ways. Further, it is important that students come to see the two-way relationship between concrete embodiments of a mathematical concept and the notational system used to represent it."

References:

Fuson and Briars 1990; Hiebert and Wearne 1992; Labinowicz 1985; Resnick and Omanson 1987; Sowell 1989; Suydam and Higgins 1977; Thompson 1992.

7.7. Openness to Student Solution Methods and Student Interaction:

Teaching that incorporates students' intuitive solution methods can increase student learning, especially when combined with opportunities for student interaction and discussion.

Research findings:

Two of the largest and most important ongoing research programs in mathematics education in the U.S. are the Cognitively Guided Instruction (CGI) project being conducted by Carpenter, Fennema, Peterson, and colleagues, and the research program of Cobb, Yackel, Wood, and colleagues, which emerges from their problem-based instructional program.

The studies from these two programs clearly demonstrate two important principles associated with the development of students' deep conceptual understanding of mathematics. First, from the CGI work, when teachers are familiar with the intuitive solution methods that students use when they solve problems, and if the teachers then use this knowledge when planning and conducting instruction in mathematics, student achievement and understanding are significantly improved. These results have been clearly demonstrated in the primary grades and are beginning to be shown at higher grade levels.

Second, the Cobb research studies found that structuring instruction around carefully chosen problems, allowing students to interact when solving problems, and providing opportunities for students to develop and discuss their own solution methods result in increased achievement on problem solving measures. These gains come without a loss of achievement on the skills and concepts measured on standardized achievement tests.

In the classroom:

The findings from these two research programs suggest that teachers must concentrate on providing opportunities for students to interact in problem-rich situations. These can include situations, for example, where students are asked to compute with numbers that are larger than or different from those that they have previously developed procedures to process. Besides providing appropriate problem-rich situations, teachers must encourage students to find their own solution methods and encourage students to share and compare their methods of finding the answer(s). One way to organize such instruction is to have students work in small groups initially and then share ideas and solutions in a whole-class discussion that follows. This is an organizational structure that has been used successfully in some of the Cobb studies.

References:

Carpenter et al. 1988; Carpenter et al. 1989; Cobb et al. 1991; Cobb, Yackel, and Wood 1992; Fennema, Carpenter, and Peterson 1989; Wood et al. 1993; Wood, Cobb, and Yackel 1995; Yackel, Cobb, and Wood 1991.

References

Brownell, W.A. 1945. "When Is Arithmetic Meaningful?" *Journal of Educational Research* Vol. 38: 481-498.

Brownell, W.A. 1947. "The Place of Meaning in the Teaching of Arithmetic." *Elementary School Journal* Vol. 47: 256-265.

Carpenter, T.P., E. Fennema, P.L. Peterson, and D. Carey. 1988. "Teachers' Pedagogical Content Knowledge of Students' Problem Solving in Elementary Arithmetic." *Journal for Research in Mathematics Education* Vol. 19: 385-401.

Carpenter, T.P., E. Fennema, P.L. Peterson, C.P. Chiang, and M. Loef. 1989. "Using Knowledge of Children's Mathematics Thinking in Classroom Teaching: An Experimental Study." *American Educational Research Journal* Vol. 26: 499-531.

Cobb, P., T. Wood, E. Yackel, J. Nicholls, G. Wheatley, B. Trigatti, and M. Perlwitz. 1991. "Assessment of a Problem-Centered Second-Grade Mathematics Project." *Journal for Research in Mathematics Education* Vol. 22: 3-29.

Cobb, P., E. Yackel, and T. Wood. 1992. "A Constructivist Alternative to the Representational View of Mind in Mathematics Education." *Journal for Research in Mathematics Education* Vol. 23: 2-23.

Davidson, N. 1985. "Small Group Cooperative Learning in Mathematics: A Selective View of the Research." In *Learning to Cooperate, Cooperating to Learn*, R. Slavin, editor (pp. 211-230). New York: Plenum Press.

Davis, M. November 1990. *Calculating Women: Precalculus in Context*. Paper presented at Third Annual Conference on Technology in Collegiate Mathematics, Columbus, OH.

Dunham, P.H. and T.P. Dick. 1994. "Research on Graphing Calculators." *Mathematics Teacher* Vol. 87: 440-445.

Fennema, E., T.P. Carpenter, and P.L. Peterson. 1989. "Learning Mathematics with Understanding: Cognitively Guided Instruction." In *Advances in Research on Teaching*, J. Brophy, editor (pp. 195-221). Greenwich, CT: JAI Press.

Flanders, J.R. 1987. "How Much of the Content in Mathematics Textbooks Is New?" *Arithmetic Teacher* Vol. 35: 18-23.

Flores, A. and D.B. McLeod. November 1990. *Calculus for Middle School Teachers Using Computers and Graphing Calculators*. Paper presented at Third Annual Conference on Technology in Collegiate Mathematics, Columbus, OH.

Fuson, K.C. and D.J. Briars. 1990. "Using a Base-Ten Blocks Learning/Teaching Approach for First- and Second-Grade Place-Value and Multidigit Addition and Subtraction." *Journal for Research in Mathematics Education* Vol. 21: 180-206.

Giamati, C.M. 1991. *The Effect of Graphing Calculator Use on Students' Understanding of Variations of Their Graphs*. Doctoral dissertation, University of Michigan. *Dissertation Abstracts International* Vol. 52: 103A. (University Microfilms No. AAC 9116100.)

Good, T.L., D.A. Grouws, and H. Ebmeier. 1983. *Active Mathematics Teaching*. New York: Longman.

Greeno, J.G. 1991. "Number Sense as Situated Knowing in a Conceptual Domain." *Journal for Research in Mathematics Education* Vol. 22: 170-218.

Harvey, J.G. September 1993. *Effectiveness of Graphing Technology in a Precalculus Course: The 1988-89 Field Test of the C^{3}PC Materials*. Paper presented at the Technology in Mathematics Teaching Conference, Birmingham, England.

Hembree, R. and D.J. Dessart. 1986. "Effects of Hand-Held Calculators in Pre-College Mathematics Education: A Meta-analysis." *Journal for Research in Mathematics Education* Vol. 17: 83-99.

Hembree, R. and D.J. Dessart. 1992. "Research on Calculators in Mathematics Education." In *Calculators in Mathematics Education, 1992 Yearbook of the National Council of Teachers of Mathematics*, J.T. Fey, editor (pp. 22-31). Reston, VA: NCTM.

Hiebert, J. and T.L. Carpenter. 1992. "Learning and Teaching with Understanding." In *Handbook of Research on Mathematics Teaching and Learning*, D.A. Grouws, editor (pp. 65-97). New York: Macmillan.

Hiebert, J. and D. Wearne. 1992. "Links Between Teaching and Learning Place Value with Understanding in First Grade." *Journal for Research in Mathematics Education* Vol. 22: 98-122.

Husén, T. 1967. *International Study of Achievement in Mathematics* (Volume 2). New York: Wiley.

Kamii, C. 1985. *Young Children Reinvent Arithmetic: Implications of Piaget's Theory*. New York: Teachers College Press.

Kamii, C. 1989. *Young Children Continue to Reinvent Arithmetic: Implications of Piaget's Theory*. New York: Teachers College Press.

Keeves, J.P. 1976. "Curriculum Factors Influencing School Learning." *Studies in Educational Evaluation* Vol. 2: 167-184.

Keeves, J.P. 1994. *The World of School Learning: Selected Key Findings from 35 Years of IEA Research*. The Hague, Netherlands: International Association for the Evaluation of Educational Achievement (IEA).

Kilpatrick, J. 1992. "A History of Research in Mathematics Education." In *Handbook of Research on Mathematics Teaching and Learning*, D.A. Grouws, editor (pp. 3-38). New York: Macmillan.

Knapp, M.S., P.M. Shields, and B.J. Turnbull. 1995. "Academic Challenge in High-Poverty Classrooms." *Phi Delta Kappan* Vol. 77: 770-776.

Koehler, M. and D.A. Grouws. 1992. "Mathematics Teaching Practices and Their Effects." In *Handbook of Research on Mathematics Teaching and Learning*, D.A. Grouws, editor (pp. 115-126). New York: Macmillan.

Labinowicz, E. 1985. *Learning from Students: New Beginnings for Teaching Numerical Thinking.* Menlo Park, CA: Addison-Wesley.

Lave, J. 1988. *Cognition in Practice.* Cambridge, MA: Cambridge University Press.

Markovits, Z. and J. Sowder. 1994. "Developing Number Sense: An Intervention Study in Grade 7." *Journal for Research in Mathematics Education* Vol. 25: 4-29.

McKnight, C.C., F.J. Crosswhite, J.A. Dossey, E. Kifer, J.O. Swafford, K.J. Travers, and T.J. Cooney. 1987. *The Underachieving Curriculum.* Champaign, IL: Stipes Publishing Company.

Mullis, I.V.S., F. Jenkins, and E.G. Johnson. 1994. *Effective Schools in Mathematics: Perspectives from the NAEP 1992 Assessment.* Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement. (Report No. 23-RR-01).

National Council of Teachers of Mathematics. 1989. *Curriculum and Evaluation Standards for School Mathematics.* Reston, VA: NCTM.

Resnick, L.B. and S.F. Omanson. 1987. "Learning to Understand Arithmetic." In *Advance in Instructional Psychology,* R. Glaser, editor (Vol. 3, pp. 41-95). Hillsdale, NJ: Lawrence Erlbaum Associates.

Reys, B.J., R. Barger, B. Dougherty, L. Lembke, A. Parnas, R. Sturdevant, M. Bruckheimer, J. Hope, Z. Markovits, S. Reehm, and M. Weber. 1991. *Developing Number Sense in the Middle Grades.* Reston, VA: National Council of Teachers of Mathematics.

Reys, B.J. and R.H. Barger. 1994. "Mental Computation: Issues from the United States Perspective." In *Computational Alternatives for the Twenty-first Century,* R.E. Reys and N. Nohda, editors, (pp. 31-47). Reston, VA: National Council of Teachers of Mathematics.

Rich, B.S. 1991. *The Effects of the Use of Graphing Calculators on the Learning of Function Concepts in Precalculus Mathematics.* Doctoral dissertation, University of Iowa. *Dissertation Abstracts International* Vol. 52: 835A. (University Microfilms No. AAC 9112475.)

Ruthven, K. 1990. "The Influence of Graphic Calculator Use on Translation from Graphic to Symbolic Forms." *Educational Studies in Mathematics* Vol. 21: 431-450.

Skemp, R.R. 1978. "Relational Understanding and Instrumental Understanding." *Arithmetic Teacher* Vol. 26: 9-15.

Slavin, R.E. 1990a. *Cooperative Learning: Theory, Research, and Practice.* Englewood Cliffs, NJ: Prentice-Hall.

Slavin, R.E. 1990b. "Student Team Learning in Mathematics." In *Cooperative Learning in Math: A Handbook for Teachers,* N. Davidson, editor, (pp. 69-102). Reading, MA: Addison-Wesley.

Sowder, J. 1992a. "Estimation and Number Sense." In *Handbook of Research on Mathematics Teaching and Learning,* D.A. Grouws, editor (pp. 371-389). New York: Macmillan.

Sowder, J. 1992b. "Making Sense of Numbers in School Mathematics." In *Analysis of Arithmetic for Mathematics Education,* G. Leinhardt, R. Putnam, and R. Hattrup, editors (pp. 1-51). Hillsdale, NJ: Lawrence Erlbaum Associates.

Sowell, E.J. 1989. "Effects of Manipulative Materials in Mathematics Instruction." *Journal for Research in Mathematics Education* Vol. 20: 498-505.

Stevenson, H.W., S.Y. Lee, and J. Stigler. 1986. "Mathematics Achievement of Chinese, Japanese, and American Children." *Science* Vol. 231: 693-699.

Suydam, M.N. and J.L. Higgins. 1977. *Activity-based Learning in Elementary School Mathematics: Recommendations from Research.* Columbus, OH: ERIC Center for Science, Mathematics, and Environmental Education.

Thompson, P.W. 1992. "Notations, Conventions, and Constraints: Contributions of Effective Uses of Concrete Materials in Elementary Mathematics." *Journal for Research in Mathematics Education* Vol. 23: 123-147.

Van Engen, H. 1949. "An Analysis of Meaning in Arithmetic." *Elementary School Journal* Vol. 48: 395-400.

Webb, N.M. 1991. "Task-Related Verbal Interaction and Mathematics Learning in Small Groups." *Journal for Research in Mathematics Education* Vol. 22: 366-389.

Wood, T., P. Cobb, E. Yackel, and D. Dillon. 1993. "Rethinking Elementary School Mathematics: Insights and Issues." *Journal for Research in Mathematics Education Monographs, 6.*

Wood, T., P. Cobb, and E. Yackel. 1995. "Reflections on Learning and Teaching Mathematics in Elementary School." *Constructivism in Education,* L.P. Steffe and J. Gale, editors (pp. 401-422). Hillsdale, NJ: Lawrence Erlbaum Associates.

Yackel, E., P. Cobb, and T. Wood. 1991. "Small-Group Interactions as a Source of Learning Opportunities in Second-Grade Mathematics." *Journal for Research in Mathematics Education* Vol. 22: 390-408.

Chapter 8. Physical Education

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This chapter consists of eight practices that contribute to effective physical education programs. These practices have widespread support from physical education professionals across the United States. Most have been supported by extensive research examining the teaching-learning environment in urban, suburban, and rural settings. Several of the practices incorporate standards and guidelines approved by the National Association for Sport and Physical Education (NASPE 1995).

The NASPE curriculum standards identify seven content standards for school physical education:

- Students should demonstrate competency in many and proficiency in a few movement forms. This suggests that students should have numerous opportunities in elementary and middle school to become competent in a variety of sports, dance, gymnastics, and aquatics activities. In high school, students should continue to develop proficiency in movement forms in which they are particularly interested or talented.
- Students should apply movement concepts and principles to the learning and development of motor skills. This includes an understanding of the physiological, biomechanical, psychological, and sociological aspects of learning and performing skillful movement.
- Students should achieve and maintain fitness. Students must be permitted to participate in physical activity frequently (at least three times a week), at a moderate level of intensity, for a minimum of 20 to 30 minutes duration.
- Students should participate in and understand the costs and benefits of health-enhancing physical activity. They should have the opportunity to make decisions about their own fitness needs and gain a greater understanding of the consequences of their decisions.
- Students should demonstrate responsible personal and social behavior in physical activity settings. They should have the opportunity to learn personally and socially responsible behaviors through participation in sports and fitness tasks that promote cooperation, leadership, caring, and respect for others.
- Students should understand and respect differences among people in physical activity settings. They should participate in activities in which they become aware of and appreciate differences in performance based on body size, strength, and coordination.
- Students should understand that physical activity provides opportunities for enjoyment, challenge, self-expression, and social interaction. Students should be encouraged to think about physical activity as a source of enjoyable and rewarding experiences both during the school years and throughout one's life.

Quality physical education is an essential element in the total school program. A quality physical education program teaches students skills and knowledge necessary to participate in an active lifestyle. Students learn fundamental movements, skills, sport, dance, and fitness activities. Learning occurs in an atmosphere that is enjoyable and that entices students to develop positive attitudes toward physical activity. Effective physical educators incorporate a variety of teaching styles and strategies to communicate the content and motivate students to learn. The time allotted to physical education within the school day is an opportunity for students to gain life skills and attitudes that promote active, healthy living.

Research and empirical evidence that support the multiple health benefits of regular physical activity continue to mount. Engaging in regular physical activity relieves tension and stress, helps in weight management, lowers the rate of many diseases, and increases life expectancy. A sedentary lifestyle is an independent risk factor for coronary heart disease, nearly doubling a person's risk. Because more people are at risk of coronary heart disease due to physical inactivity than to any other single risk factor (i.e., smoking, high blood pressure, high cholesterol), regular physical activity has an especially important health impact (U.S. Department of Health and Human Services 1990).

Participation in school physical education ensures a minimum amount of physical activity for children. Findings of the National Children and Youth Fitness Studies I and II suggest that participating in quality physical education programs for a minimum of 20-30 minutes a day at least three days a week has a significant positive effect on the health-related fitness of children and youth. Because time spent engaged in regular, vigorous physical activity outside of school declines sharply during the fall and winter, daily school physical education programs can play an important role in helping children and youth maintain a high level of physical activity year round (U.S. Department of Health and Human Services 1990).

8.1. Time for Practice: Time spent practicing specific skill, sport, and fitness content leads to the development of skillful and fit movers.

Research findings:

A large body of research exists to support the importance of focused, appropriate practice in physical education. This research was initiated in the 1970s and continues to the present. Although most early research focused on teacher behaviors that contribute to effective time-on-task, research conducted in the 1990s is providing specific evidence to link the time students spend practicing a motor task with their level of achievement.

There is a direct relationship between the amount of time a student spends practicing a skill and the degree of learning that occurs. Research suggests that three components of practice are essential for student learning. First, the student must spend enough time engaged in practicing the task to learn and refine the movement. Second, the difficulty of the task must match the student's current ability (see Principle 8.2). Third, the student must mentally concentrate on performing the task correctly (see Principle 8.3). This assumes that each student has a piece of equipment with which to practice and that the class size reflects that of a typical classroom so that the teacher can work with individual students to provide specific, corrective feedback to improve performance.

It is important to point out that student practice, alone, is insufficient to enhance achievement. The practice must be at an appropriate level of difficulty and focused on the attainment of an educationally sound objective.

In the classroom:

An educational physical education program requires high levels of practice time to enhance student learning. The first step in creating an effective program is to ensure that students spend as much of the available class time in appropriate practice as possible.

Academic learning time in physical education is defined as time in which each student is performing or cognitively engaged in thinking about performance. Students need to be active throughout the class period. Activity might include participating in learning tasks, performing skill-enhancing drills, and working at target heart rate. High student time-on-task occurs when each student has a piece of equipment, a place to practice, and an interesting and challenging activity to perform. Students standing in lines, sitting out of games, and engaging in off-task or disruptive behavior are signals that the class lacks appropriate task structures, adequate equipment, or stimulating content.

References:

Cousineau and Luke 1990; Godbout, Brunelle, and Tousignant 1983; Goldberger and Gerney 1990; Griffey and Housner 1991; Lee and Poto 1988; Magill 1994; Metzler 1989; Rickard 1991; Rink 1993; Silverman 1985a, 1985b, 1990, 1991; Silverman, Tyson, and Morford 1988.

8.2. Appropriate Practice: Tasks that are appropriate to the learning objective and to the ability of the learner increase the level of the learner's physical skills.

Research findings:

Research supporting the nature and specificity of tasks has greatly contributed to our understanding of class structures that promote student achievement. Task difficulty has been found to be a critical variable in the learning process. This research suggests that either multiple tasks or tasks with multiple levels of difficulty should be used to accommodate the wide range of skill levels present in most physical education classes. Task multiplicity is also necessary to challenge learners as their ability increases.

In the classroom:

Teachers should take care to engage students at a level of difficulty that is challenging and one that encourages practice, effort, and persistence. Tasks that are too difficult or too easy do not permit students to practice at a level in which they can be both challenged and successful. Thus, simply being involved in a game in which one does not have appropriate skills to be successful is not considered appropriate practice.

Tasks must be carefully designed to reflect the learning objective, and should include several levels of difficulty so that students can initiate practice at a level in which they can find success and then move to more difficult tasks.

Tasks must be adjusted to reflect students' current abilities if learning is to occur. Students cannot perform skills for which they do not have adequate strength or coordination. Low-skilled students must practice tasks that enhance their ability to build strength and coordination. If the practice conditions are too complex or too game-like, students will not be able to perform the skills necessary to improve. Very precise task progressions are required to place as many students as possible within appropriate tasks (see Principle 8.5). As students improve their skillfulness and ability to adjust to changing situations in lead-up games, they should then play in more game-like settings. Tasks must ultimately reflect game-like conditions for students to acquire the skills necessary to participate in traditional sports. This can be accomplished by building several levels of performance into each task or adjusting the dimensions of the task, such as the weight and size of the object, the speed of the object or the mover, and the distance or size of the target.

References:

Ashy, Lee, and Landin 1988; Buck, Harrison, and Bryce 1991; Edwards 1988; French, Rink, and Werner 1990; Hastie and Saunders 1990; Magill 1993; Masser 1985; Rink 1994; Tousignant and Siedentop 1983.

8.3. Cognitive Engagement: Students who are challenged to think about movement make better decisions about when, where, and under what conditions to use the skill, strategy, or concept to enhance performance.

Research findings:

Research in motor learning has suggested that learning of tasks or skills at beginning and intermediate levels is enhanced when students attend to the critical factors or cues that contribute to effective performance. As learners become more skilled, their cognitive focus shifts from performing the skill to monitoring the environment to determine contextual factors that influence temporal and spatial parameters essential to success.

Some researchers are currently examining the influence of context factors on learning. Research suggests that contextual interference (for example, distractions or frequently changing practice conditions) during early stages of learning requires learners to attend to these factors and adjust their performances as they learn. Although this process appears to require a more extended learning period, the performer's ability to make modifications is enhanced and is more consistent with the requirements of advanced performance, such as in game or sport situations.

In the classroom:

Physical education tasks require learners to be both cognitively and physically engaged to be successful. Learner attention and critical thinking skills are essential to enhance performance. Cognitive processing is important in anticipating, planning, regulating, and interpreting motor performance. Students must think about the task to design an accurate motor plan for each movement response. If students have adequate strength and coordination, but cannot perform, it may be that their cognitive plan is faulty. Teachers facilitate cognitive engagement through task sequencing and questioning that focus student attention on the most critical physical, spatial, and temporal aspects of the performance.

Cognitive engagement is especially critical at the beginning stages of learning a skill. The learner must translate the demonstration, teaching cues, and the task requirements into a motor program to execute the skill. As students become more proficient, they focus less on the cognitive aspects of how to perform the task, and more on the product of the performance (for example, scoring the goal). Students often stop concentrating when the task becomes repetitive or is not adjusted to reflect learning. Teachers should provide interesting, challenging tasks; change the tasks frequently; and ask questions either verbally, on task cards, or through a peer teacher to help learners remain cognitively involved during the initial stages of learning.

References:

Edwards and Lee 1985; French, Rink, and Werner 1990; Graham 1987; Lyndon and Cheffers 1984; Madden and McGown 1989; Magill 1993; Silverman 1991.

8.4. Task-Specific Communication: Task explicitness enhances students' ability to engage successfully in the learning process.

Research findings:

Research results suggest that achievement of motor skills and strategies is dependent on the use of specific, corrective feedback that: 1) captures student attention, 2) focuses student attention on the component of the skill to be changed, and 3) presents feedback in a manner that is understandable and meaningful to the student. General comments such as "nice job" may contribute to self-esteem, but do not contribute to skill development. Recent research suggests that presenting effective feedback is especially difficult in large classes with diverse learners.

In the classroom:

Task explicitness means communicating to the learner the task directions, the criterion for performance, and the outcomes of the desired performance. Effective teachers use six steps to enhance task specific communication. First, they signal for students' attention, encouraging them to focus on the demonstration or particular aspects of the performance. Second, they make instructions clear and understandable, using visual, verbal, and kinesthetic descriptions. Third, they check with students frequently to be sure they have understood the directions. Fourth, they structure and sequence the task so students focus on the critical components. Fifth, they summarize and repeat information to be sure that all students have heard the information and can use it to enhance performance. Sixth, they monitor and evaluate student performance throughout the task. Clarity of information is coupled with structure and motivation to enhance student learning.

Teachers should communicate both the sequence in which the tasks should be performed and the characteristics of a good performance. Students need to be fully informed about the manner in which they will engage in learning. This includes both a clear statement of the learning goal in student-friendly terms and a description of the task to be used to accomplish the learning goal. Students also should have a clear conceptualization of the criteria for correct performance or the goals of a problem-solving task. This can be accomplished through student or teacher demonstration or the use of task cards, wall posters, or check sheets. Verbal cues from teachers or peer teachers emphasize critical features of a skill and may also help to make the task clear to the learner.

References:

Block and Beckett 1990; Graham 1988; Graham et al. 1993; McCullagh, Stiehl, and Weiss 1990; Rink 1994; Silverman 1991; Silverman, Kulinna, and Crull 1995.

8.5. Content Sequencing: Progressive sequencing of tasks permits students to build new knowledge on a solid foundation of existing knowledge.

Research findings:

Research on sequencing suggests that achievement is enhanced when skills are presented in a progressive sequence. Researchers have examined many different sequencing progressions associated with skill and sport instruction. Simple to complex, part to whole, and whole to part sequencing are all effective in presenting foundational knowledge and building progressive, complex additions to that knowledge. When instruction consists of only a review of foundational knowledge in short units, students may become bored and develop misconceptions about the quality of their performance. It is important that sequences include increasingly more complex information to challenge student interest and provide the next levels of information necessary to enhance achievement.

In the classroom:

Effective sequencing is based on the teacher's ability to analyze the skill to be learned and break it down into small, progressive steps that contribute to learning. Students do not learn the complex skills necessary to participate in a game by simply playing the game. Instead, skills and strategies must be developed in tasks and lead-up activities that begin with the most fundamental components. Students must learn the knowledge presented at each step and be able to demonstrate their ability to perform the skill before moving to more complex steps that combine two or more basic components. Progressive sequencing also helps students refine their movements and apply new skills to interesting and enjoyable activities that are appropriately sequenced to enhance student success.

Students make substantial learning gains when content progressions are organized from simple to complex and tasks with a refining focus are used. In fact, when progressions are inappropriately sequenced, student performance may actually regress. Teachers can break skills down into components, such as the toss, hit, and follow-through in a volleyball hit, or develop progressions related to more challenging levels of performance, such as ball placement, spin, and speed. Although some skills cannot or should not be broken down because of the negative effect on the timing of the movement, most complex motor skills are more easily learned through a progressive sequence. Refining tasks should include the use of specific, corrective feedback given to a particular student at the completion of a skill. This feedback focuses on substantive errors that require correction. Often, the correction of one particular component of performance (such as body position) leads to dramatic improvement.

References:

Buck and Harrison 1990; French and Thomas 1987; French, Rink, and Werner 1990; French et al. 1991; Housner and Griffey 1985; Masser 1985; Rink et al. 1992.

8.6. Spiral Curriculum: Revisiting important topics at increasing levels of sophistication in different units and grades provides multiple opportunities for students to develop movement competency and proficiency.

Research findings:

Research to confirm the value of a spiral curriculum has not been conducted in physical education. Support for this form of curriculum macro-sequencing rest on the recognized importance of building progressive educational sequences that are consistently revisited at more complex levels of information.

In the classroom:

Physical-skill learning requires the student to engage in numerous skill trials over an extended period of time. As students' abilities improve, they need to be challenged by increasingly complicated tasks that apply their skills in interesting and exciting situations. For this to occur, instructional units should be of reasonably long duration. A unit might also be revisited two or three times a year so that students have adequate opportunities to practice. Each time a skill or sport is revisited, the topic should be reviewed to encourage students' attention to the essential components taught in previous lessons. Teachers then present new, more complex information that requires students to use prior knowledge to accomplish new tasks.

Concept-based approaches to curriculum are especially appropriate in physical education. Concepts from physics (such as leverage or force production/absorption) and life sciences (for example, circulation or nutrition) can be studied as students participate in a variety of tasks. These concepts naturally cross instructional units, grades, and subject areas. Students have the opportunity to develop both depth and breadth of understanding and performance ability within a spiral curriculum.

Macro-sequencing of concepts and topics provides logical progressions across units and grades to enhance learning. The National Association for Sport and Physical Education, in its statement of Outcomes and Standards, provides specific examples of macro-sequencing in physical education across grades K-12. At each level, previously taught concepts and skills are reinforced while new, more sophisticated concepts are introduced. The concepts are carefully sequenced to provide a developmentally appropriate curriculum that leads to the development of physically educated persons.

References:

National Association for Sport and Physical Education 1992, 1995; Rink et al. 1992.

8.7. Developmental Program Focus: Programs focused on the development of fundamental movement and fitness knowledge and skills, and their application to physical activity, are essential to the development of physically educated persons.

Research findings:

Motor development research indicates that learners are most successful in acquiring new motor skills during the preschool and elementary years. Students' coordinative structures and neurological pathways are developing rapidly during this period and are receptive to the development of fundamental movement patterns and basic skills. They can then refine, extend, and apply these patterns to more complex skills during adolescence. Ability to learn new, complex motor patterns in adolescence is constrained due to a number of neurological factors.

Developmental physical education is structured to be consistent with and to contribute to the individual's emerging motor and cognitive functioning. There is an extensive body of research in exercise physiology regarding the importance of participating in physical activity at moderate levels of intensity. Other research suggests that some students do not come to physical education class with the personal and social skills necessary to listen, follow directions, and work productively with others. Physical education goals to address these concerns contribute to students' ability to function within school and physical education.

In the classroom:

The curriculum focus in physical education should be on the development of fundamental movement skills and fitness concepts that contribute to the individuals' desire to participate in physical activity as part of an active, healthy lifestyle. Teachers should structure the learning environment to foster student engagement with skill and fitness tasks at appropriate levels of difficulty.

Students should develop movement fundamentals in the elementary grades and refine and apply those skills to lead-up sports and fitness activities at the middle and high school levels. Participation in physical activity across the life span depends on the development of skills, knowledge, and attitudes necessary to engage in physical activities with personally satisfying levels of success.

References:

DeBusk and Hellison 1990; Ennis 1994a, 1994b; Griffin 1985; Jewett, Bain, and Ennis 1995; McBride 1990; National Association for Sport and Physical Education 1992, 1995.

8.8. Administrative Support: Administrative support of an academic, learning-oriented focus in physical education is critical to the development of physically educated students.

Research findings:

Research suggests that all teachers must be held accountable for the quality of their programs. Studies in motivational theory confirm that when individuals do not receive support and constructive critiques of their work, their motivation declines and their job performance suffers. Administrators' support for physical education contributes directly to teachers' perceptions of status, to their teaching efficacy, and to their motivation to perform effectively. It is an essential component of a quality physical education program.

In the classroom:

Administrators must have high expectations for physical educators and provide them with the support and resources necessary to run an effective program. Teachers need to work within an environment in which there are clear expectations for student learning in physical education. Physical education programs can contribute to the educational mission of the school through a focus on critical thinking skills and an opportunity for cross-disciplinary applications of content in settings that students find enjoyable. Students can engage in mathematics as they keep game statistics, journalism as they write about sport contests, poetry as they communicate a special moment in performance, or history as they trace the development of a sport within the context of national events. Administrative support is an essential element in quality physical education programs at every school level.

Administrators must resist the temptation to think of physical education as a recreational program in which students are entertained and socialized. Simply keeping students "happy, busy, and good" during physical education class is not acceptable. Although physical education can contribute to positive social interaction and cooperative behaviors, these should occur as one part of the total physical education program. Students who are skilled and fit and can make appropriate decisions to engage in an active, healthy lifestyle are often more willing and able to be good citizens of the school and community. They attain enhanced self-concept and self-efficacy based on their developing physical ability. Students will learn quickly that physical education is an integral part of the school curriculum and a place where they come to learn in an enjoyable and intellectually stimulating environment.

Physical educators often work in physically isolated areas of the school and have limited contact with other teachers. It is important for administrators to visit the gym as often as they visit other classrooms.

References:

Ennis in press; Ennis, Ross, and Chen 1992; Graham 1987; Gusthart and Springings 1989; Johnson, Bjorkland, and Krotee 1984; Martinek 1988; National Association for Sport and Physical Education 1992, 1995; Placek 1984.

References

Ashy, M., A. Lee, and D. Landin. 1988. "Relationship of Practice Using Correct Technique to Achievement in a Motor Skill." *Journal of Teaching in Physical Education* Vol. 7: 115-120.

Block, K.K. and K.D. Beckett. 1990. "Verbal Descriptions of Skill by Specialists and Nonspecialists." *Journal of Teaching in Physical Education* Vol. 10: 21-37.

Buck, M. and J. Harrison. 1990. "An Analysis of Game Play in Volleyball." *Journal of Teaching in Physical Education* Vol. 10: 38-48.

Buck, M., J. Harrison, and G.R. Bryce. 1991. "An Analysis of Learning Trials and Their Relationship to Achievement." *Journal of Teaching in Physical Education* Vol. 10: 134-152.

Cousineau, W. and M. Luke. 1990. "Relationships Between Teacher Expectations and Academic Learning Time in Sixth Grade Physical Education Basketball Classes." *Journal of Teaching in Physical Education* Vol. 9: 262-271.

DeBusk, M. and D. Hellison. 1990. "Teaching for Social Responsibility." *Journal of Teaching in Physical Education* Vol. 11: 156-147.

Edwards, R.V. 1988. "The Effects of Performance Standards on Behavior Patterns and Motor Skill Achievement in Children." *Journal of Teaching in Physical Education* Vol. 7: 90-102.

Edwards, R.V. and A.M. Lee. 1985. "The Relationship of Cognitive Style and Instructional Strategy to Learning and Transfer of Motor Skills." *Research Quarterly for Exercise and Sport* Vol. 56: 286-290.

Ennis, C.D. 1994a. "Urban Secondary Teachers' Value Orientations: Social Goals for Teaching." *Teaching and Teacher Education* Vol. 10: 109-120.

Ennis, C.D. 1994b. "Urban Secondary Teachers' Value Orientations: Delineating Curricular Goals for Social Responsibility." *Journal of Teaching in Physical Education* Vol. 13: 163-179.

Ennis, C.D. (In press). "When Avoiding Confrontation Leads to Avoiding Content: Disruptive Students' Impact on Curriculum." *Journal of Curriculum and Supervision.*

Ennis, C.D., J. Ross, and A. Chen. 1992. "The Role of Value Orientations in Curricular Decision Making: A Rationale for Teachers' Goals and Expectations." *Research Quarterly for Exercise and Sport* Vol. 63: 38-47.

French, K.E. and G. Thomas. 1987. "The Relation of Knowledge Development to Children's Basketball Performance." *Journal of Sport Psychology* Vol. 9: 15-32.

French, K.E., J.E. Rink, and P.H. Werner. 1990. "Effects of Contextual Interference on Retention of Three Volleyball Skills." *Perceptual and Motor Skills* Vol. 71: 179-186.

French, K.E., J. Rink, L. Rickard, A. Mays, S. Lynn, and P. Werner. 1991. "The Effects of Practice Progressions on Learning Two Volleyball Skills." *Journal of Teaching in Physical Education* Vol. 10: 261-275.

Godbout, P., J. Brunelle, and M. Tousignant. 1983. "Academic Learning Time in Elementary and Secondary Physical Education." *Research Quarterly for Exercise and Sport* Vol. 54: 11-19.

Goldberger, M. and P. Gerney. 1990. "Effects of Learner Use of Practice Time on Skill Acquisition." *Journal of Teaching in Physical Education* Vol. 10: 84-95.

Graham, K.C. 1987. "A Description of Academic Work and Student Performance During a Middle School Volleyball Unit." *Journal of Teaching in Physical Education* Vol. 7: 22-37.

Graham, K.C. 1988. "A Qualitative Analysis of an Effective Teacher's Movement Task Presentations During a Unit of Instruction." *The Physical Educator* Vol. 11: 187-195.

Graham, K.C., K. Hussey, K. Taylor, and P. Werner. 1993. "A Study of Verbal Presentations of Three Effective Teachers." *Research Quarterly for Exercise and Sport* Vol. 64: 87.

Griffey, D.C. and L.D. Housner. 1991. "Differences Between Experienced and Inexperienced Teachers Planning Decisions, Interactions, Student Engagement and Instructional Climate." *Research Quarterly for Exercise and Sport* Vol. 62: 196-204.

Griffin, P.S. 1985. "Teachers' Perceptions of and Responses to Sex Equity Problems in a Middle School Physical Education Program." *Research Quarterly for Exercise and Sport* Vol. 56: 103-110.

Gusthart, J.L. and E.J. Springings. 1989. "Student Learning as a Measure of Teacher Effectiveness in Physical Education." *Journal of Teaching in Physical Education* Vol. 8: 298-311.

Hastie, P.A. and J.E. Saunders. 1990. "A Study of Monitoring in Secondary School Physical Education Classes." *Journal of Classroom Interactions* Vol. 25: 47-54.

Housner, L.D. and D.C. Griffey. 1985. "Teacher Cognition: Differences in Planing and Interactive Decision Making Between Experienced and Inexperienced Teachers." *Research Quarterly for Exercise and Sport* Vol. 56: 46-53.

Jewett, A.E., L.L. Bain, and C.D. Ennis. 1995. *The Curriculum Process in Physical Education.* Dubuque, IA: Wm. C. Brown.

Johnson, R.T., R. Bjorkland, and M. Krotee. 1984. "The Effects of Cooperative, Competitive and Individualistic Student Interaction Patterns on the Achievement and Attitudes of Students Learning the Golf Skill of Putting." *Research Quarterly for Exercise and Sport* Vol. 55: 129-134.

Lee, A. M. and C. Poto. 1988. "Instructional Time Research in Physical Education: Contributions and Current Issues." *Quest* Vol. 40: 63-73.

Lyndon, M.C. and J.T.F. Cheffers. 1984. "Decision-Making in Elementary School-Age Children: Effects on

Motor Learning and Self-Concept Development." *Research Quarterly for Exercise and Sport* Vol. 55: 135-140.

Madden, G. and C. McGown. 1989. "The Effect of the Inner Game Method Versus the Progressive Method on Learning Motor Skills." *Journal of Teaching in Physical Education* Vol. 9: 39-48.

Magill, R.A. 1993. *Motor Learning: Concepts and Applications.* Dubuque, IA: Wm. C. Brown.

Magill, R.A. 1994. "The Influence of Augmented Feedback During Skill Learning Depends on Characteristics of the Skill and the Learner." *Quest* Vol. 46: 314-327.

Martinek, T.J. 1988. "Confirmation of a Teacher Expectancy Model: Student Perceptions and Causal Attributions of Teaching Behaviors." *Research Quarterly for Exercise and Sport* Vol. 59: 118-126.

Masser, L. 1985. "The Effect of Refinement on Student Achievement in a Fundamental Motor Skill in Grades K-6." *Journal of Teaching in Physical Education* Vol. 6: 174-182.

McBride, R.E. 1990. "Sex Role Stereotyping Behaviors Among Elementary, Junior, and Senior High School Physical Education Specialists." *Journal of Teaching in Physical Education* Vol. 9: 249-261.

McCullagh, P., J. Stiehl, and M. Weiss. 1990. "Developmental Modeling Effects on the Quantitative and Qualitative Aspects of Motor Performance." *Research Quarterly for Exercise and Sport* Vol. 61: 344-350.

Metzler, M. 1989. "A Review of the Research on Time in Sport Pedagogy." *Journal of Teaching in Physical Education* Vol. 8: 87-103.

National Association for Sport and Physical Education. 1992. *Quality Physical Education.* Reston, VA: Author.

National Association for Sport and Physical Education. 1995. *Content Standards and Assessment Guide for School Physical Education.* Reston, VA: Author.

Placek, J.H. 1984. "A Multi-Case Study of Teacher Planning in Physical Education." *Journal of Teaching in Physical Education* Vol. 4: 39-49.

Rickard, L. 1991. "The Short Term Relationship of Teacher Feedback and Student Practice." *Journal of Teaching in Physical Education* Vol. 10: 275-285.

Rink, J. 1993. *Teaching Physical Education for Learning.* St. Louis, MO: Times/Mirror Mosby.

Rink, J. 1994. "Task Presentation in Pedagogy." *Quest* Vol. 46: 270-280.

Rink, J., K. French, P. Werner, S. Lynn, and A. Mays. 1992. "The Influence of Content Development on the Effectiveness of Instruction." *Journal of Teaching in Physical Education* Vol. 11: 139-149.

Silverman, S. 1985a. "Student Characteristics Mediating Engagement-Outcome Relationships in Physical Education." *Research Quarterly for Exercise and Sport* Vol. 56: 66-72.

Silverman, S. 1985b. "Relationship of Engagement and Practice Trials to Student Achievement." *Journal of Teaching in Physical Education* Vol. 5: 13-21.

Silverman, S. 1990. "Linear and Curvilinear Relationships Between Student Practice and Achievement in Physical Education." *Teaching and Teacher Education* Vol. 6: 305-314.

Silverman, S. 1991. "The Validity of Academic Learning Time-Physical Education (Alt-PE) as a Process Measure of Student Achievement." *Research Quarterly for Exercise and Sport* Vol. 62: 319-325.

Silverman, S., L.A. Tyson, and L.M. Morford. 1988. "Relationships of Organization, Time, and Student Achievement in Physical Education." *Teaching and Teacher Education* Vol. 4: 247- 257.

Silverman, S., P. Kulinna, and G. Crull. 1995. "Skill Related Task Structures, Explicitness, and Accountability: Relationships with Student Achievement." *Research Quarterly for Exercise and Sport* Vol. 66: 32-41.

Tousignant, M. and D. Siedentop. 1983. "A Qualitative Analysis of Task Structures in Required Secondary Physical Education Classes." *Journal of Teaching in Physical Education* Vol. 3: 47-57.

United States Department of Health and Human Services. 1990. *Healthy People 2000: National Health Promotion and Disease Prevention Objectives.* Washington, DC: Author.

Chapter 9. Science

Dorothy Gabel

The science education research literature of the last 10 years is replete with studies indicating that students at all levels possess many inaccurate conceptions of scientific knowledge. Although this may also have been the case in the past, it appears more prevalent now, and is at least in part caused by the rapid growth of scientific knowledge.

Analyses of textbooks indicate that they contain many more concepts than they have in the past, with fewer pages devoted to explaining or describing each particular concept. In addition, the science curriculum has shifted down, so that rather complex topics that 20 years ago were thought too difficult for students at particular grade levels are now being taught at those levels. Whether this increase of content coverage is the result of international comparisons of students in the United States with students in other countries is a moot point. The result is that students have little time to think about what they are learning, rarely see individual concepts taught in a multitude of contexts, do not see the relevance of what they are learning, frequently have negative attitudes toward science, and resort to memorizing facts and solving problems algorithmically in order to survive!

The teaching strategies and practices that research has shown to be effective in improving achievement in the teaching and learning of science all have one thing in common: they keep students' attention focused on learning. Whether this is done by pausing after asking a question before calling on a student to answer the question (wait time), by involving students in decision making (computer simulations), or by having students make comparisons with familiar situations (using analogies), all of these strategies require active learning. Many involve creating situations that challenge students' assumptions by having them make observations that are in conflict with their beliefs (cognitive conflict), and then resolving the conflict. It is only when instruction involves or at least begins with topics that are of interest to students, and is related to their world, that students will learn in more authentic ways. That is, they will see the relationship between what they are learning and what they already know; they will think instead of memorize.

Although several of the strategies included in this review can be used by teachers and students on an individual basis, there is a growing body of evidence that learning is a social endeavor and that strategies that include interactions between students (cooperative learning) are more effective than activities in which students work alone. This appears to be true even when students work at a computer using probeware or computer simulations. Interactions among students help them clarify their own ideas and those of their peers.

All of the teaching strategies presented here (with the exception of using computer simulations) also require additional time to implement in the classroom. This increase of instructional time per concept will require educators to consider carefully which of many important concepts should be taught at particular grade levels, and which should be delayed or even omitted from the curriculum. One way this can be accomplished is to integrate science instruction across the disciplines, as suggested by the American Association for the Advancement of Science's recommendations in *Benchmarks for Science Literacy, Project 2061* (1993), and by the National Science Teachers Association in *Scope, Sequence and Coordination of Secondary School Science* (1993). A reduction of the science content included at the pre-college level has also been recommended by the National Research Council in the *National Science Education Standards* (1994).

9.1. Learning Cycle Approach: The use of the learning cycle approach (exploration, invention, and application) results in better content achievement, improved thinking skills, and more positive attitudes toward science.

Research findings:

Numerous studies beginning in the 1960s and continuing today indicate that the learning cycle approach is effective in promoting both conceptual understanding and positive attitudes toward science and process skill acquisition for students at the elementary, middle school, and high school levels. When laboratory experiences (exploration and application) are combined with concept introduction (invention), positive outcomes occur. However, research on the effectiveness of laboratory instruction by itself, without concept introduction, does not support its effectiveness in improving student achievement in science.

In the classroom:

The learning cycle approach as originally envisioned in the early 1960s for the teaching of elementary science included three phases: exploration, invention, and discovery. During the exploration phase, students explore new materials and ideas with minimum guidance. This helps students raise questions about the phenomena being explored that cannot be resolved by their accustomed way of thinking and identify patterns of regularity in the phenomena. The invention phase is more teacher-centered. Terms and concepts are introduced that explain the patterns discovered in the exploration phase. In the application phase, students apply the terms and concepts to new situations, thus learning to generalize in a broader context.

The learning cycle approach has been incorporated into a variety of science curricula and programs, particularly at the elementary level. These include *Science Curriculum Improvement Study* (SCIS) and *Biological Sciences Curriculum Study* (BSCS). Recent studies have shown that using the learning cycle approach is an effective way to determine and correct students' misconceptions, and that it can aid in improving young students' reasoning abilities. Studies indicate that all three phases are necessary, although in some instances an in-depth laboratory experience may substitute for some phases.

Current research indicates that modifications of the learning cycle can make it an even more effective instructional strategy. Helping students to focus their exploration by adding an engagement or prediction/discussion phase and following the application phase with evaluation appear to promote conceptual understanding. A monograph by Lawson, Abraham, and Renner (1989) provides a rich description of the use and possible modifications of the learning cycle approach.

References:

Abraham 1989; Bybee et al. 1989; Campbell 1977; Carlson 1975; Davis 1977; Davison 1989; Glasson and Lalik 1990; Jackman, Moellenberg and Brabson 1990; Lavoie 1989, 1992; Lawson and Wollman 1976; Lawson, Abraham and Renner 1989; Lawson and Weser 1990; Marek and Methven 1991; McKinnon and Renner 1971; Purser and Renner 1983; Renner, Abraham, and Birnie 1985; Renner and Marek 1988; Rubin and Norman 1989, 1992; Scharmann 1992; Schneider and Renner 1980; Ward and Herron 1980; Westbrook, Rogers, and Marek 1990.

9.2. Cooperative Learning: Using cooperative learning for classroom and laboratory instruction increases student achievement, attitudes, and on-task behavior.

Research findings:

A considerable number of research studies on the effectiveness of cooperative learning using the jigsaw approach in the classroom and the investigative approach in the laboratory indicate its usefulness for the teaching of science. Although studies in the early 1980s focused on the elementary school level, studies from the mid-1980s show that middle school and high school science students also profit from the use of these cooperative learning approaches.

In the classroom:

The use of cooperative learning for the teaching of science has improved science achievement at all grade levels. In the classroom, cooperative groups of about four students frequently use the jigsaw approach, in which each student in a given group takes a particular role or part of a larger task. Students with the same role from each of the other jigsaw groups in the class form a new group in which each member investigates/learns his or her part of the topic. After members of this group have shared ideas and learned the material or performed the task, they return to their original group where they are responsible for sharing what they have learned and teaching students in that original group the new information.

In most investigative cooperative groups that are used for laboratory instruction, each member of the group of four takes on a different role such as recorder, checker, facilitator, or experimenter. Roles rotate with each lab investigation. In almost all studies of cooperative learning, there is positive interdependence, face-to-face interaction, individual accountability, interpersonal and small-group interactions, and group processing.

Some of the potential benefits of cooperative learning are increased achievement scores including long-term retention, more positive attitudes toward laboratory work, higher self-esteem, higher laboratory and process skill achievement, and greater on-task behavior. One area where cooperative learning has not been shown to be successful at the secondary level is increasing students' ability to solve problems. The most effective form of cooperative learning appears to occur when students are encouraged to cooperate within their group but to compete with other groups within the class.

References:

Hay 1980; Humphreys, Johnson, and Johnson 1982; Johnson and Johnson 1985a, 1985b; Jones and Steinbrink 1989, 1991; Kempa and Ayob 1991; Lazarowitz 1991; Lazarowitz et al. 1985; Lazarowitz et al. 1988; Lazarowitz and Karsenty 1990; Lazarowitz, Hertz-Lazarowitz, and Baird 1994; Lonning 1993; Okebukola 1985a, 1985b, 1986a, 1986b, 1986c; Okebukola and Ogunniyi 1984; Rogg and Kahle 1992; Sherman 1989; Slavin 1980, 1984, 1991; Tingle and Good 1990; Walters 1988; Watson 1991; Webb 1985.

9.3. Analogies: Using analogies in the teaching of science results in the development of conceptual understanding by enabling the learner to compare something familiar to something unfamiliar.

Research findings:

Although some research studies prior to the 1980s have been conducted on the use of analogies, a new interest in this area has produced several in-depth studies which indicate that using analogies assists in concept development. This is particularly true when students have alternative conceptions about a particular concept. Research in this area tends to be qualitative in nature, and the conceptual change that occurs may not result in higher scores on multiple-choice science tests of facts and concepts.

In the classroom:

Textbooks and teachers sometimes use analogies to help familiarize students with concepts that are abstract and outside their previous experience. To be effective, analogies must be familiar to students, and their features/functions must be congruent with those of the target. Since adult perspectives are not identical with those of adolescents, it is not surprising that, even though students are familiar with the physical phenomenon or event that might be used as the analogy, they are not always familiar with those features that provide the similarity to the target. Once a suitable analogy is found, considerable time must be spent by students in discussion of similarities between the analogy and the target. It is also important for students to understand how the analogy and target differ. Sometimes this can be done by using multiple analogies to teach the same concept. At other times it may be necessary to construct "bridging" analogies.

Analogies occurring in texts may be simple—based on surface similarities—or more complex (particularly in chemistry and physics)—based on similarities of function. The use of functional analogies appears to be more appropriate at the secondary level where students have developed appropriate reasoning strategies.

The discussion that occurs when using analogies not only helps students construct their own knowledge but also assists teachers in basing instruction on students' prior knowledge and existing misconceptions. Analogies may also motivate students to learn by provoking their interest. Finally, having students create their own analogies also appears to be an effective instructional strategy.

References:

Brown 1992; Clement 1993; Dagher 1994; Dagher and Cossman 1992; Duit 1991b; Dupin and Joshua 1989; Flick 1991; Friedel, Gabel, and Samuel 1990; Gabel and Samuel 1986; Garnett and Treagust 1992; Glynn 1991; Griffiths and Preston 1992; Harrison and Treagust 1993; Lawson 1993; Stavy 1991; Stavy and Tirosh 1993; Sutula and Krajcik 1988; Thagard 1992; Thiele and Treagust 1994; Treagust et al. 1992; Wong 1993a, 1993b; Zeitoun 1984.

9.4. Wait Time: Pausing after asking a question in the classroom results in an increase in achievement.

Research findings:

In most classrooms, students are typically given less than one second to respond to a question posed by a teacher. Research shows that under these conditions students generally give short, recall responses or no answer at all rather than giving answers that involve higher-level thinking. Studies beginning in the early 1970s and continuing through the 1980s show that if teachers pause between three and seven seconds after asking higher-level questions, students respond with more thoughtful answers and science achievement is increased. This finding is consistent at the elementary, middle school, and high school levels and across the science disciplines.

However, some research studies have suggested that the benefits of increasing wait time may depend on factors such as student expectations and the cognitive level of the questions. In a study of increased wait time in a high school physics class, students became more apathetic in classes where the wait time was increased. This might have occurred because this strategy did not match students' expectations of how a high school physics course should be conducted. In a study at the elementary level, a decrease in achievement was attributed to waiting too long for responses to low-level questions.

In the classroom:

Increasing the wait time from three to seven seconds results in an increase in 1) the length of student responses, 2) the number of unsolicited responses, 3) the frequency of student questions, 4) the number of responses from less capable children, 5) student-student interactions, and 6) the incidence of speculative responses. In addition to pausing after asking questions, research shows that many of these same benefits result when teachers pause after the student's response to a question, and when teachers do not affirm answers immediately.

Increasing wait time also increases science achievement. Research indicates that when teachers increase their wait time to more than three seconds in class discussions, achievement on higher-cognitive-level science test items increases significantly. This holds for test items involving content, the process skills, and items involving probabilistic reasoning.

However, care must be taken in applying wait time judiciously. The optimal wait time for a given question should be adjusted to the cognitive level of the question, and student responses should be carefully monitored.

References:

Altiere and Duell 1991; Anderson 1978; Fowler 1975; Garigliano 1972; Lake 1973; Riley 1986; Rowe 1974a, 1974b, 1986; Samiroden 1983; Tobin 1985, 1986, 1987; Tobin and Capie 1982.

9.5. Concept Mapping: The use of student-generated and teacher-generated concept maps for teaching science concepts results in improved student achievement and more positive student attitudes.

Research findings:

Over 150 studies on concept mapping have been reported since the late 1970s. A careful meta-analysis conducted by Horton et al. of 19 studies that qualified out of 133 reported by 1990 indicates positive effects on student achievement and attitudes. (The analysis included only studies that occurred in actual classrooms using control groups and in which sufficient quantitative data were reported.) One hundred references related to concept mapping have been reported by Al-Kunifed and Wandersee.

In the classroom:

A concept map is a schematic diagram or semantic network that includes concepts arranged in a hierarchical order linked by words that form propositions. Concept maps can be made by teachers or students either individually or in a group. They are used in a variety of situations, such as in an overview at the beginning of a unit, during instruction to assess conceptual understanding, and at the end of a unit to review for a test or to evaluate learning. Concept mapping in the science classroom, particularly for biology instruction, improves science achievement and attitudes. The use of concept maps appears to be more beneficial at the end of a unit than at the beginning. Although there appears to be no difference in student achievement whether the maps are constructed by the teacher or by the students, there are greater gains in achievement when students supply the key terms to construct the maps.

In addition to their direct use in classroom instruction, concept maps also have other educational benefits for students. They can help teachers become more effective and can be used as an aid in curriculum development.

References:

Al-Kunifed and Wandersee 1990; Beyerbach and Smith 1990; Fisher 1990; Horton et al. 1993; Hoz, Tomer, and Tamir 1990; Novak and Gowin 1984; Novak and Musonda 1991; Pankratius 1990; Roth 1994; Roth and Roychoudhury 1992; Starr and Krajcik 1990; Wallace and Mintzes 1990; Willerman and Mac Harg 1991; Wilson 1994.

9.6. Computer Simulations: Using computer simulations to represent real-world situations enables students to become more reflective problem solvers and to increase their conceptual understanding.

Research findings:

Data from a survey of secondary science departments in the fall of 1992 indicate that 49 percent of those surveyed used computers in teaching science at least occasionally. Although the most common use of computers was for simulations, only 18 percent of the schools surveyed indicated that computers were used once or twice per week.

Convincing research studies on the use of simulations in science instruction at the upper elementary and secondary levels are needed to justify more widespread and frequent use of this strategy.

In the classroom:

Many scientific models are difficult or impossible to observe, or are so complex that they are difficult to study in the laboratory. In chemistry, for example, students cannot observe the motion of atoms in solids, liquids, and gases because of their size. In physics, the study of velocity and acceleration becomes difficult in the laboratory because the observer has to account for friction. In biology, studies of genetics might have to extend over a prolonged time period.

Computer simulations can overcome these obstacles by simplifying complex systems, and then incorporating the various complexities to show their effect on the system. Use of simulations tends to result in increased achievement on complex and difficult concepts in less time than conventional instruction. Simulations (sometimes referred to as microworlds) can be used by instructors in classroom settings; however, the most effective use is by students either alone or in small groups. This permits guided exploration by students of the variations of the system, leads to better conceptual understanding and achievement, and appears to increase students' problem-solving and process skills. As with analogies, the use of simulations may create misconceptions, and so requires careful teacher attention to the understandings (or misunderstandings) produced. They should not be used exclusively in place of laboratory activities, and care must be taken by teachers to help students identify the limitations of the simulated models.

References:

Berge 1990; Berger 1982, 1984, 1987; Choi and Gennaro 1987; diSessa 1988; Faryniarz and Lockwood 1992; Geban, Askar, and Ozkan 1992; Hakerem, Dobrynina, and Shore 1993; Jungck and Calley 1986; Kinnear 1983; Krajcik 1989; Lehman 1994; Linn 1988; Njoo and de Jong 1993; Rivers and Vockell 1987; Simmons 1989; Wells and Berger 1986; White and Frederickson 1989; White and Horowitz 1987, 1988; Williamson and Abraham 1995; Wiser and Kipman 1988; Zeitsman and Hewson 1986.

9.7. Microcomputer-Based Laboratories: Using computers to collect and display data from science experiments enables students at the secondary level to understand science concepts and learn to use science process skills.

Research findings:

Although the research in this area is somewhat limited, several studies indicate the value of students' participation in microcomputer-based laboratories; these studies outweigh other studies showing no improvement over traditional laboratory approaches. The use of computers in the science classroom is still limited in scope, and hence only a limited number of studies have been conducted to date.

In the classroom:

In a microcomputer-based laboratory (MBL) experiment, students use electronic probes that are interfaced with a microcomputer that directly records and graphs data being collected. This enables students to immediately see the trends in the data as they are being collected, and to focus on the meaning of the experiment rather than on completing a data table or making a graph. This may enable students to question their prior beliefs and to ask new questions related to the experiment. The effectiveness of using these scientific probes depends greatly on the instructional sequence in which they are used.

In comparisons with traditional instruction, MBL use frequently results in a different set of outcomes. For example, students using MBLs are better able to interpret graphs, whereas students with conventional laboratory experiences are better able to construct graphs. Because both are important instructional outcomes, it is recommended that MBLs be interspersed with conventional laboratory experiences, rather than used exclusively.

References:

Adams and Shrum 1990; Beichner 1990; Berger 1987; Brasell 1987; Friedler, Nachmias, and Linn 1990; Grayson and McDermott 1989; Jackson, Edwards, and Berger 1993; Krajcik and Layman 1989; Lewis and Linn 1989; Linn and Songer 1988; Mokros and Tinker 1987; Nakhleh and Krajcik 1994; Tinker 1985; Wise 1988; Wiser and Kipman 1988.

9.8. Systematic Approaches in Problem Solving: Planning the solutions to mathematical chemistry and physics problems in a systematic way enables students to more frequently solve the problems correctly.

Research findings:

Most of the studies on mathematical problem solving in the sciences have examined processes students use to solve chemistry and physics problems. Mathematical problem solving in biology focuses on genetics, and research on using a systematic approach in solving these types of problems is lacking. Polya in the 1940s suggested the four-step approach described below, which researchers have modified over the years.

In the classroom:

Expert problem solvers take a considerable length of time in planning and analyzing a given problem before using mathematics for its solution. Novice problem solvers appear to use cues in the problem to search their memory for a formula or algorithm that they can use to solve the problem. Unfortunately, if superfluous information is given in a problem, this frequently causes them to use an incorrect formula.

Novice problem solvers can improve their problem solving skills if they use a systematic approach such as: 1) understanding the problem; 2) devising a plan; 3) carrying out the plan; and 4) looking back. In order to understand the problem, students must identify what information is given in the problem, and what is sought. Sometimes drawing a picture (such as a force diagram in physics or a picture of what is happening on the molecular level in chemistry) aids in understanding the problem. Using this information, students then formulate plans for the problem solution. Helping students categorize problems into specific types enhances the planning stage. The final step, looking back, involves checking the mathematics used, the execution of the plan, and the reasonableness of the answer.

These steps are not necessarily sequential in nature. For example, during the planning stage it may be necessary to revert to the understanding phase to recall additional information needed or to eliminate superfluous information. The steps do not come naturally to students, and need to be illustrated and practiced when students are taught to solve problems. In addition, because using a systematic approach requires more time than simply using a formula, care must be taken to assign fewer, but more varied, problems for practice, and to allow more time for problem solving on tests.

References:

Bhaskar and Simon 1977; Bunce et al. 1990; Bunce, Gabel, and Samuel 1991; Bunce and Heikkinen 1986; Cameron 1985; Chi, Feltovich, and Glaser 1981; de Jong and Ferguson-Hessler 1986; Frank and Herron 1987; Hegarty 1991; Heller and Hollabaugh 1992; Heller, Keith, and Anderson 1992; Heller and Reif 1984; Kramers-Pals, Lambrechts, and Wolff 1982; Larkin 1980; Lesgold and Lajoie 1991; Mettes et al. 1980; Polya 1945; Reif 1983; Reif and Heller 1982; Schoenfeld 1978; Stiff 1988; Van Heuvelen 1991; Wright and Williams 1986.

9.9. Conceptual Understanding in Problem Solving: Understanding concepts qualitatively enables students to solve quantitative problems in physics and chemistry more effectively.

Research findings:

Research at the secondary and even post-secondary level on understanding of basic concepts that are involved in solving many chemistry and physics problems (such as mass and volume) indicate that students do not understand these concepts. This is confirmed by many research studies on problem solving in which students solve problems aloud. Although there is a limited amount of research to indicate that understanding basic concepts qualitatively improves mathematical problem solving, it appears that this would be the case.

In the classroom:

Many secondary students use algorithms to solve chemistry and physics problems that require the use of mathematics. They substitute data given in a problem into a formula (or use the factor-label method), perform appropriate mathematical operations, and arrive at a correct solution. However, when asked about the meaning of what they have done or requested to describe the variables and the relationship among the variables involved, they are unable to do so.

There is some evidence that having students perform numerous problems in this manner does not necessarily lead to conceptual understanding. If conceptual understanding is the expected outcome of science instruction, a more reasonable approach would be to emphasize a qualitative understanding of the underlying concepts first, and then to use mathematical problem solving to provide deeper insight into the concepts. For example, many students can calculate the density of a solid, yet when shown samples of identical mass but different volumes, are unable to serial order the samples by density. It is unlikely that having students solve numerous density problems by substituting values into the density formula will help them distinguish between density and volume.

References:

Anamuah-Mensah 1986; Bhaskar and Simon 1977; Bunce, Gabel, and Samuel 1991; Chi, Feltovich, and Glaser 1981; de Jong and Ferguson-Hessler 1986; Finegold and Mass 1985; Gabel 1981; Gabel, Sherwood, and Enochs 1984; Gorodetsky and Hoz 1980; Griffiths, Pottle, and Whelan 1983; Hegarty 1991; Heller, Keith, and Anderson 1992; Herron and Greenbowe 1986; Larkin 1980, 1983; Larkin et al. 1980; Lythcott 1990; McMillan and Swadener 1991; Niaz and Robinson 1989; Reif and Heller 1982; Robertson 1990; Schmidt 1990; Sumfleth 1988; Sweller 1988; Ward and Sweller 1990.

9.10. Science-Technology-Society: Using a Science-Technology-Society approach in the teaching of science results in an increase in the number of students taking additional science courses and advanced-level courses, as well as changing students' attitudes towards science and their understanding of the nature of science and its relationship to technology and societal issues.

Research findings:

Studies in this area are somewhat limited. Most comparative studies have been performed by one major researcher, and include students in grades four through nine. However, AAAS's *Project 2061* and the National Research Council's draft of the *National Science Education Research Standards* endorse the inclusion of science, technology, and society issues in the curriculum. Furthermore, curriculum developers in Canada and in the United Kingdom include this approach in widely used national curriculum projects at the secondary levels.

There is little evidence that STS increases students' knowledge of facts, concepts, or principles, but no evidence that it decreases it. When STS is integrated into the curriculum as a major thrust (not as vignettes), positive outcomes occur. These include an increase in understanding the process and applications of science, as well as improving creativity and attitudes toward science. An additional benefit found in Canada was improving students' understanding of science as a way of knowing. In the United Kingdom, STS was found to dramatically increase the number of students taking additional science courses. In the U.S., new curricula have been developed by the ACS in chemistry using this approach at the middle school and high school levels.

In the classroom:

Educators should consider using Science-Technology-Society (STS) approaches to the curriculum as a way to make science more relevant to students' lives. STS issues can be included as vignettes as a small part of the curriculum. However, based on the research results, a more promising approach is to use STS as an entire course that has as its objectives the development of an appreciation of the interactive nature of science, technology, and society; knowledge of technology as applications of science; the ability to respond critically to technology issues; or a combination of these goals with teaching science concepts and principles.

References:

Aikenhead and Ryan 1992; American Association for the Advancement of Science 1993; Barker 1993a, 1993b; Ben-Zvi and Gai 1994; Bybee 1987; Campbell et al. 1994; Hart and Robottom 1990; McFadden 1991; Myers 1988; National Research Council 1994; National Science Teachers Association 1982, 1991; Ramsden 1992, 1994; Rosenthal 1989; Rubba, McGuyer, and Wahlund 1991; Sutman and Bruce 1992; Waks and Barchi 1992; Winther and Volk 1994; Yager and Tamir 1993; Yager, Tamir, and Mackinnu 1993; Yager and Yager 1985; Zoller et al. 1990.

9.11. Real-Life Situations: Using real-life situations in science instruction through the use of technology (films, videotapes, videodiscs, CD ROMS) or through actual observation increases student interest in science, problem-solving skills, and achievement.

Research findings:

Research support for the use of real-life situations (or simulations of these) in classroom instruction continues to increase as the technologies for bringing real-life situations into the classroom become more available to teachers. The leading research group in the United States using anchored instruction to increase middle school students' problem-solving skills is located at Vanderbilt University. Several of the bibliographic entries include summaries of its work.

In the classroom:

Students frequently compartmentalize learning. For example, many students who have studied mathematics are unable to apply it in solving problems in chemistry and physics. Many fail to associate the variable "x" used extensively in algebra problems to letters standing for variable names in physics problems. Even within the science course itself, many students fail to recognize that the topics they are studying apply to real-life situations. One reason proposed for this lack of transfer is that problem solving and learning have not taken place in real-world contexts. The use of videotapes or discs depicting real-life situations or simulations of these (either alone or in tandem with computers) makes it much more feasible to teach using real-world situations.

Videodiscs using simulations of real-world problem-solving situations, developed to improve students' mathematics and science problem-solving skills, have been used successfully by middle school students at several different sites. Although results indicate no difference in standardized test achievement, this finding was considered to be positive because time normally spent on conventional instruction was reduced to allow for the use of the problem-solving videodiscs which did have a positive effect on students' problem-solving skills. The instruction surrounding the use of the videodiscs was very carefully structured by classroom teachers, and this appears to be an important factor in the use of technology in the classroom.

The use of interactive videodiscs is also proving to be an important instructional strategy. Guidance in using the videodiscs is programmed and controlled by a computer that directs students' attention and frequently requires students to make decisions about their own learning. Effective programs, particularly at the secondary and college levels, show that student achievement and attitudes improve with their use, and that in some cases interactive videodiscs are an effective substitute for conventional laboratory experiences such as dissections in biology.

References:

Bereiter and Scardamalia 1989; Bohren 1993; Brown 1992; Brown, Collins, and Duguid 1989; Cobb 1994; Cognition and Technology Group at Vanderbilt 1992, 1993; Dawson 1991; Hofmeister, Engelmann, and Carnine 1988; Kinzie, Strauss, and Foss 1993; Leonard 1992; Lockhart, Lamon, and Gick 1988; Meyers 1993; Savenye and Strand 1989; Smith and Jones 1988.

9.12. Discrepant Events: Using discrepant events in science instruction results in cognitive conflict that enhances students' conceptual understanding.

Research findings:

There is little direct research evidence that using discrepant events (occurrences in nature that are at odds with students' current thought) promotes conceptual understanding. However, two of the practices included in this chapter (Learning Cycle Approach and Real-Life Situations) are thought to be effective because they frequently include discrepant events. Discrepant events are one form of anomalous data that help students focus on their prior conceptions, a step that is thought to be necessary if students are to alter their conceptions so that they become closer to the accepted scientific view. During the exploration phase of the learning cycle, students may confront anomolous data, or such data may be included in instruction based on real-world situations. The reference by Chinn and Brewer provides the theoretical framework for using anomalous data in science instruction.

In the classroom:

Many science teachers use discrepant events frequently in their teaching, and this practice has been advocated by authors of methods texts over the years. An example of a discrepant event from physics instruction would be to drop a Styrofoam and a steel ball of equal volumes from the same height at the same time and note that both hit the floor at the same time. Because most students think that the heavier ball will hit first, the event is discrepant.

Although discrepant events frequently take the form of demonstrations, all demonstrations do not necessarily include discrepant events. Discrepant events can be built into hands-on activities that students actually perform and can be included in computer simulations and on videodiscs.

Just because students view or experience something that is discrepant does not guarantee that they will learn from the situation. Students may ignore or reject it. In order to maximize its effectiveness, the anomolous data must be credible and unambiguous. A recommended strategy for effective instruction includes the following steps: 1) consider a physical scenario of unknown outcome; 2) predict the outcome; 3) construct one or more theoretical explanations; 4) observe the outcome; 5) modify the theoretical explanation; 6) evaluate competing explanations; and 7) repeat the previous steps with another discrepant event illustrating the same theory or concept.

References:

Chinn and Brewer 1993; Dreyfus, Jungwirth, and Eliovitch 1990; Duit 1991a; Lawson 1990; Linn and Songer 1991.

References

Abraham, M.R. 1989. "Research and Teaching: Research on Instructional Strategies." *Journal of College Science Teaching* Vol. 18: 185-187.

Adams, D.D. and J.W. Shrum. 1990. "The Effects of Microcomputer-based Laboratory Exercises on the Acquisition of Line Graph Construction and Interpretation Skills by High School Biology Students." *Journal of Research in Science Teaching* Vol. 27: 777-787.

Aikenhead, G.S. and A.G. Ryan. 1992. "The Development of a New Instrument: Views on Science-Technology-Society." *Science Education* Vol. 76: 477-491.

Al-Kunifed, A. and J.H. Wandersee. 1990. "One Hundred References Relating to Concept Mapping." *Journal of Research in Science Teaching* Vol. 27: 1069-1075.

Altiere, M.A. and O.K. Duell. 1991. "Can Teachers Predict Their Students' Wait Time Preferences?" *Journal of Research in Science Teaching* Vol. 28: 455-461.

American Association for the Advancement of Science. 1993. *Benchmarks for Science Literacy, Project 2061.* New York: Oxford University Press.

Anamuah-Mensah, J. 1986. "Cognitive Strategies Used by Chemistry Students to Solve Volumetric Analysis Problems." *Journal of Research in Science Teaching* Vol. 23: 759-769.

Anderson, B.O. 1978. *The Effects of Long Wait-Time on High School Physics Pupils' Response Length, Classroom Attitudes and Achievement.* Doctoral dissertation, University of Minnesota. *Dissertation Abstracts International* Vol. 39: 3493A. (University Microfilms No. 78-23, 871.)

Barker, V. 1993a. *16 Year Old Students' Understanding of the Conservation of Matter in Chemical Reactions* (Science Education Research Paper 93/03). York, UK: Department of Educational Studies, University of York.

Barker, V. 1993b. "An Investigation of 16-18 Year Old Students' Understanding of Basic Chemical Ideas." In *European Research in Science Education. Proceedings of the First Ph.D. Summer School,* P. Lijns, editor (pp. 175-183). Utrecht: CD-b Press.

Beichner, R.J. 1990. "The Effect of Simultaneous Motion Presentation and Graph Generation in a Kinematics Lab." *Journal of Research in Science Teaching* Vol. 27: 803-815.

Ben-Zvi, N. and R. Gai. 1994. "Macro- and Micro-Chemical Comprehension of Real World Phenomena." *Journal of Chemical Education* Vol. 71: 730-732.

Bereiter, C. and M. Scardamalia. 1989. "Intentional Learning as a Goal of Instruction." In *Knowing, Learning, and Instruction: Essays in Honor of Robert Glaser,* L.B. Resnick, editor (pp. 361-392). Hillsdale, NJ: Lawrence Erlbaum Associates.

Berge, Z.L. 1990. "Effects of Group Size, Gender, and Ability Grouping on Learning Science Process Skills Using Microcomputers." *Journal of Research in Science Teaching* Vol. 27: 747-759.

Berger, C. 1982. "Attainment of Skill in Using Science Processes. I: Instrumentation, Methodology and Analysis." *Journal of Research in Science Teaching* Vol. 19: 249-260.

Berger, C. 1984. "Learning More than Facts: Microcomputer Simulation in the Science Classroom." In *Intelligent School House: Readings on Computers and Learning,* D. Peterson, editor. Reston, VA.

Berger, C. April 1987. *Misconceptions and Thin Conceptions of Teachers Using Microcomputer-based Laboratories.* Paper presented at the meeting of the American Educational Research Association, Washington, DC.

Beyerbach, B. and J. Smith. 1990. "Using a Computerized Concept Mapping Program to Assess Preservice Teachers' Thinking About Effective Teaching." *Journal of Research in Science Teaching* Vol. 27: 961-972.

Bhaskar, R. and H.A. Simon. 1977. "Problem Solving in Semantically Rich Domains: An Example from Engineering Thermodynamics." *Cognitive Science* Vol. 1: 193-215.

Bohren, J.L. 1993. *Science Learning and Interactive Videodisc Technology.* Paper presented at the annual meeting of the International Visual Literacy Association, Pittsburgh, PA. (ERIC Document Reproduction Service No. ED 363 286.)

Brasell, H. 1987. "The Effect of Real-Time Laboratory Graphing on Learning Graphic Representations of Distance and Velocity." *Journal of Research in Science Teaching* Vol. 24: 385-395.

Brown, A.L. 1992. "Design Experiments: Theoretical and Methodological Challenges in Creating Complex Interventions in Classroom Settings." *Journal of the Learning Sciences* Vol. 2: 141-178.

Brown, D.E. and J. Clement. 1992. "Using Examples and Analogies to Remediate Misconceptions in Physics: Factors Influencing Conceptual Change." *Journal of Research in Science Teaching* Vol. 29: 17-34.

Brown, J.S., A. Collins, and P. Duguid. 1989. "Situated Cognition and the Culture of Learning." *Educational Researcher* Vol. 18, No. 1: 32-42.

Bunce, D.M. and H. Heikkinen. 1986. "The Effects of an Explicit Problem-Solving Approach on Mathematical Chemistry Achievement Using Problem Categorization." *Journal of Research in Science Teaching* Vol. 28: 11-20.

Bunce, D.M., K. Baxter, A. DeGennaro, B. Jackson, J. Lyman, M. Olive, and B. Yohe. December 1990. *Teaching Students to Solve Chemistry Problems—A Cooperative Research Project.* Paper presented at the annual meeting of the National Science Teachers Association, Washington, DC.

Bunce, D.M., D.L. Gabel, and K.B. Samuel. 1991. "Enhancing Chemistry Problem-Solving Achievement Using Problem Categorization." *Journal of Research in Science Teaching* Vol. 28: 505-521.

Bybee, R.W. 1987. "Science Education and the Science/Technology/Society (STS) Theme." *Science Education* Vol. 71: 667-683.

Bybee, R.W., C.E. Buchwald, S. Crissman, D.R. Heil, P.J. Kuerbis, C. Matsumoto, and J.D. McInerney. 1989.

Science and Technology Education for the Elementary Years: Frameworks for Curriculum and Instruction. Washington, DC: National Center for Improving Science Education.

Cameron, D.L. 1985. "A Pictorial Framework to Aid Conceptualization of Reaction Stoichiometry." *Journal of Chemical Education* Vol. 62: 510-511.

Campbell, B., J. Lazonby, R. Millar, P. Nicolson, J. Ramsden, and D. Waddington. 1994. "Science: The Salters Approach—A Case Study of the Process of Large Scale Curriculum Development." *Science Education* Vol. 78: 415-447.

Campbell, T.C. 1977. "An Evaluation of a Learning Cycle Intervention Strategy for Enhancing the Use of Formal Operational Thought by Beginning College Physics Students." *Dissertation Abstracts International* Vol. 36, No. 7: 3903A.

Carlson, D.A. 1975. "Training in Formal Reasoning Abilities Provided by the Inquiry Rose Approach and Achievement on the Piagetian Formal Operational Level. *Dissertation Abstracts International* Vol. 36, No. 11: 7368A.

Chi, M.T.H., P.S. Feltovich, and R. Glaser. 1981. "Categorization and Representation of Physics Problems by Experts and Novices." *Cognitive Science* Vol. 5: 121-152.

Chinn, C.A. and W.F. Brewer. 1993. "The Role of Anomalous Data in Knowledge Acquisition: A Theoretical Framework and Implications for Science Instruction." *Review of Educational Research* Vol. 63: 1-49.

Choi, B.S. and E. Gennaro. 1987. "The Effectiveness of Using Computer Simulated Experiments on Junior High Students' Understanding of the Volume Displacement Concept." *Journal of Research in Science Teaching* Vol. 24: 539-552.

Clement, J. 1993. "Using Bridging Analogies and Anchoring Intuitions to Deal with Students' Preconceptions in Physics." *Journal of Research in Science Teaching* Vol. 30: 1241-1257.

Cobb, P. 1994. "Where Is the Mind? Constructivist and Socio-Cultural Perspectives on Mathematical Development." *Educational Researcher* Vol. 23, No. 7: 13-20.

Cognition and Technology Group at Vanderbilt. 1992. "Anchored Instruction in Science and Mathematics: Theoretical Basis, Developmental Projects, and Initial Research Findings." *Educational Researcher* Vol. 19, No. 6: 2-10.

Cognition and Technology Group at Vanderbilt. 1993. "Anchored Instruction and Situated Cognition Revisited." *Educational Technology* Vol 33: 52-70.

Dagher, Z.R. 1994. "Does the Use of Analogies Contribute to Conceptual Change?" *Science Education* Vol. 78: 601-614.

Dagher, Z. and G. Cossman. 1992. "Verbal Explanations Given by Science Teachers: Their Nature and Implications." *Journal of Research in Science Teaching* Vol. 29: 361-374.

Davis, J.O. 1977. "The Effects of Three Approaches to Science Instruction on the Science Achievement, Understanding, and Attitudes of Selected Fifth and Sixth Grade Students." *Dissertation Abstracts International* Vol. 39: 211A.

Davison, M.A. 1989. *Use of the Learning Cycle to Promote Cognitive Development.* Doctoral dissertation, Purdue University, 1988. *Dissertation Abstracts International* Vol. 49: 3320-A.

Dawson, G. 1991. *Science Vision: An Inquiry-based Videodisc Science Curriculum.* (ERIC Document Reproduction Service No. ED 336 257.)

de Jong, T. and M.G.M. Ferguson-Hessler. 1986. "Cognitive Structures of Good and Poor Novice Problem Solvers in Physics." *Journal of Educational Psychology* Vol. 78: 279-288.

diSessa, A.A. 1988. "Knowledge in Pieces." In *Constructivism in the Computer Age,* G. Forman and P.B. Pufal, editors. Hillsdale, NJ: Lawrence Erlbaum Associates.

Dreyfus, A., E. Jungwirth, and R. Eliovitch. 1990. "Applying the 'Cognitive Conflict' Strategy for Conceptual Change—Some Implications, Difficulties, and Problems." *Science Education* Vol. 74: 555-569.

Duit, R. 1991a. "Students' Conceptual Frameworks: Consequences for Learning Science." In *The Psychology of Learning Science,* S.M. Glynn, R.H. Yeany, and B.K. Britton, editors (pp. 65-85). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Duit, R. 1991b. "On the Role of Analogies and Metaphors in Learning Science." *Science Education* Vol. 75: 649-672.

Dupin, J.J. and S. Joshua. 1989. "Analogies and 'Modeling Analogies' in Teaching: Some Examples in Basic Electricity." *Science Education* Vol. 73: 207-224.

Faryniarz, J.V. and L.G. Lockwood. 1992. "Effectiveness of Microcomputer Simulations in Stimulating Environmental Problem Solving by Community College Students." *Journal of Research in Science Teaching* Vol. 29: 453-470.

Finegold, M. and R. Mass. 1985. "Differences in the Process of Solving Physics Problems Between Good Physics Problem Solvers and Poor Physics Problem Solvers." *Research in Science and Technological Education* Vol. 3: 59-67.

Fisher, K. 1990. "Semantic Networking: The New Kid on the Block." *Journal of Research in Science Teaching* Vol. 27: 1001-1018.

Flick, L. 1991. "Where Concepts Meet Precepts: Stimulating Analogical Thought in Children." *Science Education* Vol. 75: 215-230.

Fowler, T.W. March 1975. *An Investigation of the Teacher Behavior of Wait Time During an Inquiry Science Lesson.* Paper presented at the annual meeting of the National Association for Research in Science Teaching. Los Angeles, California.

Frank, D.V. and J.D. Herron. April 1987. *Teaching Problem Solving to University General Students.* Paper presented at the annual meeting of the National Association for Research in Science Teaching, Washington, DC.

Friedel, A.W., D.L. Gabel, and J. Samuel. 1990. "Using Analogs for Chemistry Problem Solving: Does It Increase Understanding?" *School Science and Mathematics* Vol. 90: 674-682.

Friedler, Y., R. Nachmias, and M.C. Linn. 1990. "Learning Scientific Reasoning Skills in Microcomputer-Based

Laboratories." *Journal of Research in Science Teaching* Vol. 27: 173-191.

Gabel, D.L. February 1981. *Facilitating Problem Solving in High School Chemistry*. Bloomington, IN: Indiana University, School of Education. (ERIC Document Reproduction Service No. ED 210 192.)

Gabel, D.L., R.D. Sherwood, and L.G. Enochs. 1984. "Problem-Solving Skills of High School Chemistry Students." *Journal of Research in Science Teaching* Vol. 21: 221-233.

Gabel, D.L. and K.V. Samuel. 1986. "High School Students' Ability to Solve Molarity Problems and Their Analog Counterparts." *Journal of Research in Science Teaching* Vol. 23: 165-176.

Garigliano, L.J. 1972. *The Relation of Wait-Time to Student Behaviors in Science Curriculum Improvement Study Lessons.* Unpublished Doctoral Dissertation, Columbia University. (ERIC Document Reproduction Service No. ED 080 324.)

Garnett, P.J. and D.F. Treagust. 1992. "Conceptual Difficulties Experienced by Senior High School Students of Electrochemistry: Electric Circuits and Oxidation-Reduction Equations." *Journal of Research in Science Teaching* Vol. 29: 121-142.

Geban, O., P. Askar, and I. Ozkan. 1992. "Effects of Computer Simulations and Problem Solving Approaches on High School Students." *Journal of Educational Research* Vol. 86, No. 1: 5-10.

Glasson, G. and R. Lalik. 1990. *Interpreting the Learning Cycle from a Language Learning Perspective.* Paper presented at the annual meeting of the National Association for Research in Science Teaching, Atlanta, Georgia.

Glynn, S.M. 1991. "Explaining Science Concepts: A Teaching-with-Analogies Model." In *The Psychology of Learning Science*, S. Glynn, R. Yearny, and B. Britton, editors (pp. 219-240). Hillsdale, NJ: Erlbaum.

Gorodetsky, M. and R. Hoz. 1980. "Use of Concept Profile Analysis to Identify Difficulties in Solving Science Problems." *Science Education* Vol. 64: 671-678.

Grayson, D. and L.C. McDermott. March 1989. *Using the Computer to Identify and Address Student Difficulties with Graphing.* Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Griffiths, A.K., J. Pottle, and P. Whelan. April 1983. *Application of the Learning Hierarchy Model to the Identification of Specific Misconception for the Two Science Concepts.* Paper presented at the annual meeting of the National Association for Research in Science Teaching, Dallas, Texas.

Griffiths, A.K. and K.R. Preston. 1992. "Grade-12 Students' Misconceptions Relating to Fundamental Characteristics of Atoms and Molecules." *Journal of Research in Science Teaching* Vol. 29: 611-628.

Hakerem, G., G. Dobrynina, and L. Shore. 1993. *The Effect of Interactive, Three Dimensional, High Speed Simulations on High School Science Students' Conceptions of the Molecular Structure of Water.* (ERIC Document Reproduction Service No. ED 362 390.)

Harrison, A.G. and D.F. Treagust. 1993. "Teaching with Analogies: A Case Study in Grade-10 Optics." *Journal of Research in Science Teaching* Vol. 30: 1291-1307.

Hart, E.P. and I.M. Robottom. 1990. "The Science-Technology-Society Movement in Science Education: A Critique of the Reform Process." *Journal of Research in Science Teaching* Vol 27: 575-588.

Hay, J.A. 1980. *Effects of Cooperative Goal Structuring on Sixth Grade Science Students' Abilities to Initiate Task and Maintenance Group Behaviors.* Doctoral dissertation, Michigan State University, 1980. *Dissertation Abstracts Intenational* Vol. 41: 3857.

Hegarty, M. 1991. "Knowledge and Processes in Mechanical Problem Solving." In *Complex Problem Solving: Principles and Mechanisms,* R.J. Sternberg and P.A. Frensch, editors (pp. 253-285). Hillsdale, NJ: Lawrence Erlbaum.

Heller, J.I. and F. Reif. 1984. "Prescribing Effective Human Problem-Solving Processes: Problem Description in Physics." *Cognition and Instruction* Vol. 1: 177-216.

Heller, P., R. Keith, and S. Anderson. 1992. "Teaching Problem Solving Through Cooperative Grouping. Part 1: Group Versus Individual Problem Solving." *American Journal of Physics* Vol. 60: 627-636.

Heller, P. and M. Hollabaugh. 1992. "Teaching Problem Solving Through Cooperative Grouping. Part 2: Designing Problems and Structuring Groups." *American Journal of Physics* Vol. 60: 637-645.

Herron, J.D. and T.J. Greenbowe. 1986. "What Can We Do About Sue: A Case Study of Competence." *Journal of Chemical Education* Vol. 63: 528-531.

Hofmeister, A.M., S. Engelmann, and D. Carnine. 1988. *Developing and Validating Science Education Videodiscs.* (ERIC Document Reproduction Service No. ED 297 943).

Horton, P., A. McConney, M. Gallo, A. Woods, G. Senn, and D. Hamelin. 1993. "An Investigation of the Effectiveness of Concept Mapping as an Instructional Tool." *Science Education* Vol. 77: 95-111.

Hoz, R., Y. Tomer, and P. Tamir. 1990. "The Relations Between Disciplinary and Pedagogical Knowledge and the Length of Teaching Experience of Biology and Geography Teachers." *Journal of Research in Science Teaching* Vol. 27: 973-988.

Humphreys, B., R. Johnson, and D. Johnson. 1982. "Effects of Cooperative, Competitive, and Individualistic Learning on Students' Achievement in Science Class." *Journal of Research in Science Teaching* Vol. 19: 351-356.

Jackman, L.E., W.P. Moellenberg, and G.D. Brabson. 1990. "Effects of Conceptual Systems and Instructional Methods on General Chemistry Laboratory Achievement." *Journal of Research in Science Teaching* Vol. 27: 699-709.

Jackson, D.F., B.J. Edwards, and C.F. Berger. 1993. "Teaching the Design and Interpretation of Graphs Through Computer Aided Graphical Data Analysis." *Journal of Research in Science Teaching* Vol. 30: 483-501.

Johnson, D.W. and R.T. Johnson. 1985a. "Classroom Conflict: Controversy Versus Debate in Learning Groups."

American Educational Research Journal Vol. 22: 237-256.

Johnson, R.T. and D.W. Johnson. 1985b. "Student-Student Interaction: Ignored but Powerful." *Journal of Teacher Education* Vol. 36, No. 4: 22-26.

Jones, R. and J. Steinbrink. 1989. "Using Cooperative Groups in Science Teaching." *School Science and Mathematics* Vol. 89: 541-551.

Jones, R. and J. Steinbrink. 1991. "Home Teams: Cooperative Learning in Elementary Science." *School Science and Mathematics* Vol. 91: 139-143.

Jungck, J. and J. Calley. 1986. *Genetics: Strategic Simulations in Mendelian Genetics*. Wentworth, NH: COMPress.

Kempa, R. and A. Ayob. 1991. "Learning Interactions in Group Work in Science." *International Journal of Science Education* Vol. 13: 341-354.

Kinnear, J. 1983. *Using Computer Simulations to Enhance Problem-Solving Skills and Concept Development in Biology Students*. Paper presented at the Computer ALITE Conference, Brisbane, Australia.

Kinzie, M.B., R. Strauss, and J. Foss. 1993. "The Effects of an Interactive Dissection Simulation on the Performance Achievement of High School Biology Students." *Proceedings of Selected Research and Development Presentations at the Convention of the Association for Educational Communications and Technology*. New Orleans, LA. (ERIC Document Reproduction Service No. ED 362 173.)

Krajcik, J.S. November 1989. "Students' Interactions with Science Software Containing Dynamic Visuals." In *Meanings of Science and Technology in Schools and Communities*, M. Eisenhart and J.G. Goetz (Chairs). Symposium conducted at the 88th annual meeting of the American Anthropological Association, Washington, DC.

Krajcik, J.S. and J.W. Layman. March 1989. *Middle School Teachers' Conceptions of Heat and Temperature: Personal and Teaching Knowledge*. Paper presented at the 62nd annual meeting of the National Association for Research in Science Teaching, San Francisco.

Kramers-Pals, H., J. Lambrechts, and P.J. Wolff. 1982. "Recurrent Difficulties: Solving Quantitative Problems." *Journal of Chemical Education* Vol. 59: 509-513.

Lake, J.H. 1973. *The Influence of Wait-Time on the Verbal Dimensions of Student Inquiry Behavior*. Unpublished doctoral dissertation, Rutgers University. (ERIC Document Reproduction Service No. ED 116 897.)

Larkin, J.H. 1980. "Skilled Problem Solving in Physics: A Hierarchical Planning Model. *Journal of Structural Learning* Vol. 1: 271-297.

Larkin, J.H. 1983. "The Role of Problem Representation in Physics." In *Mental Models*, D. Gentner and A.L. Stevens, editors (pp. 75-98). Hillsdale, NJ: Lawrence Erlbaum.

Larkin, J.H., J. McDermott, D.P. Simon, and H.A. Simon. 1980. "Models of Competence in Solving Physics Problems." *Cognitive Science* Vol. 4: 317-345.

Lavoie, D. April 1989. *Enhancing the Learning Cycle with Prediction and Level Three Interactive Videodisc Lessons in Science*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, San Francisco.

Lavoie, D. March 1992. *The Effects of Adding a Prediction/Discussion Phase to a Science Learning Cycle*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Boston.

Lawson, A.E. 1990. "Use of Reasoning to a Contradiction in Grades Three to College." *Journal of Research in Science Teaching* Vol. 27: 541-551.

Lawson, A.E. 1993. "The Importance of Analogy: A Prelude to the Special Issue." *Journal of Research in Science Teaching* Vol. 30: 1213-1214.

Lawson, A.E. and W.T. Wollman. 1976. "Encouraging the Transition from Concrete to Formal Cognitive Functioning—An Experiment." *Journal of Research in Science Teaching* Vol. 13: 413-430.

Lawson, A.E., M.R. Abraham, and J.W. Renner. 1989. *A Theory of Instruction: Using the Learning Cycle to Teach Science Concepts and Thinking Skills* (Monograph of the National Association for Research in Science Teaching, No. 1). Cincinnati, OH: NARST.

Lawson, A.E. and J. Weser. 1990. "The Rejection of Nonscientific Beliefs About Life: Effects of Instruction and Reasoning Skills." *Journal of Research in Science Teaching* Vol. 27: 589-606.

Lazarowitz, R. 1991. "Learning Biology Cooperatively: An Israeli Junior High School Study." *Cooperative Learning: The Magazine for Cooperating in Education* Vol. 11: 19-21.

Lazarowitz, R., J.H. Baird, R. Hertz-Lazarowitz, and J. Jenkins. 1985. "The Effects of Modified Jigsaw on Achievement, Classroom Social Climate, and Self-Esteem in High School Science Classes." In *Learning to Cooperate, Cooperating to Learn*, R. Slavin, S. Sharan, S. Kagan, R. Hertz-Lazarowitz, N.M. Webb, and R. Schmuck, editors (pp. 231-253). New York and London: Plenum.

Lazarowitz, R., R. Hertz-Lazarowitz, J.H. Baird, and V. Bowlden. 1988. "Academic Achievement and On-Task Behavior of High School Biology Students Instructed in a Cooperative Small Investigative Group." *Science Education* Vol. 72: 475-487.

Lazarowitz, R. and G. Karsenty. 1990. "Cooperative Learning and Students' Self-Esteem in Tenth Grade Biology Classrooms." In *Cooperative Learning, Theory and Research*, S. Sharan, editor (pp. 123-149). New York: Praeger.

Lazarowitz, R., R. Hertz-Lazarowitz, and J.H. Baird. 1994. "Learning Science in a Cooperative Setting: Academic Achievement and Affective Outcomes." *Journal of Research in Science Teaching* Vol. 31: 1121-1131.

Lehman, J. 1994. "Secondary Science Teachers' Use of Microcomputers During Instruction." *School Science and Mathematics* Vol. 94: 413-420.

Leonard, W.H. 1992. "A Comparison of Student Performance Following Instruction by Interactive Videodisc Versus Conventional Laboratory." *Journal of Research in Science Teaching* Vol. 29: 93-102.

Lesgold, A. and S. Lajoie. 1991. "Complex Problem Solving in Electronics." In *Complex Problem Solving: Principles* *and Mechanisms*, R.J. Sternberg and P.A. Frensch, editors (pp. 287-316). Hillsdale, NJ: Lawrence Erlbaum.

Lewis, E.L. and M.C. Linn. April 1989. *Heat Energy and Temperature Concepts of Adolescents and Experts: Implications for Curricular Improvement.* Paper presented at the 62nd annual meeting of the National Association for Research in Science Teaching, San Francisco.

Linn, M. 1988. *Autonomous Classroom Computer Environments for Learning.* Progress report and annotated bibliography. Washington, DC: National Science Foundation. (ERIC Document Reproduction Service No. ED 305 903).

Linn, M.C. and N.B. Songer. April 1988. "Curriculum Reformulation: Incorporating Technology into Science Instruction." In *Conceptual Models of Science Learning and Science Instruction.* Symposium conducted at the annual meeting of the American Educational Research Association, New Orleans.

Linn, M.C. and N.B. Songer. 1991. "Teaching Thermodynamics to Middle School Students: What Are Appropriate Cognitive Demands?" *Journal of Research in Science Teaching* Vol. 28: 885-918.

Lockhart, R.S., M. Lamon, and M.L. Gick. 1988. "Conceptual Transfer in Simple Insight Problems." *Memory and Cognition* Vol. 16: 136-144.

Lonning, R.A. 1993. "Effect of Cooperative Learning Strategies on Student Verbal Interactions and Achievement During Conceptual Change Instruction in 10th Grade General Science." *Journal of Research in Science Teaching* Vol. 30: 1087-1101.

Lythcott, J. 1990. "Problem Solving and Requisite Knowledge of Chemistry." *Journal of Chemical Education* Vol. 67: 248-252.

Marek, E. and S. Methven. 1991. "Effects of the Learning Cycle Upon Student and Classroom Teacher Performances. *Journal of Research in Science Teaching* Vol. 28: 41-53.

McFadden, C.P. 1991. "Towards an STS School Curriculum." *Science Education* Vol. 75: 457-469.

McKinnon, J.W. and J.W. Renner. 1971. "Are Colleges Concerned with Intellectual Development?" *American Journal of Physics* Vol. 39: 1047-1052.

McMillan, C. and M. Swadener. 1991. "Novice Use of Qualitative Versus Quantitative Problem Solving in Electrostatics." *Journal of Research in Science Teaching* Vol. 28: 661-670.

Mettes, C.T.C.W., A. Pilot, H.J. Roossink., and H. Kramers-Pals. 1980. "Teaching and Learning Problem Solving in Science." *Journal of Chemical Education* Vol. 57: 882-885.

Meyers, R. 1993. *Interdisciplinary, Anchored Instruction Using Videotape.* Paper presented at the annual conference of the International Visual Literacy Association, Pittsburgh, PA. (ERIC Document Reproduction Service No. ED 363 306.)

Mokros, J.R. and R.F. Tinker. 1987. "The Impact of Microcomputer-based Labs on Children's Ability to Interpret Graphs." *Journal of Research in Science Teaching* Vol. 24: 369-383.

Myers, L.H. 1988. *Analysis of Student Outcomes in Ninth Grade Physical Science Taught with a Science/Technology/Society Focus Versus One Taught with a Textbook Orientation.* Unpublished doctoral dissertation, The University of Iowa.

Nakhleh, M.B. and J.S. Krajcik. 1994. "Influence of Levels of Information as Presented by Different Technologies on Students' Understanding of Acid, Base, and pH Concepts." *Journal of Research in Science Teaching* Vol. 31: 1077-1096.

National Research Council. November 1994. *National Science Education Standards.* Washington, DC: National Academy Press.

National Science Teachers Association. 1982. *Science-Technology-Society: Science Education for the 1980's.* Position paper. Washington, DC: National Science Teachers Association.

National Science Teachers Association. 1991. "Science/Technology/Society: A New Effort for Providing Appropriate Science for All (The NSTA Position Statement)." *NSTA Reports!* (April 1991): 36-37.

National Science Teachers Association. 1993. *Scope, Sequence, and Coordination of Secondary School Science (Volume 1). The Content Core* (Revised edition). Washington, DC: National Science Teachers Association.

Niaz, M. and W.R. Robinson. April 1989. *Teaching Algorithmic Problem Solving or Conceptual Understanding: Role of Developmental Level, Mental Capacity, and Cognitive Style.* Paper presented at the annual meeting of the National Association for Research in Science Teaching, Lake Geneva, WI.

Njoo, M. and T. de Jong. 1993. "Exploratory Learning with a Computer Simulation for Control Theory: Learning Processes and Instructional Support." *Journal of Research in Science Teaching* Vol. 30: 821-844.

Novak, J.D. and D.B. Gowin. 1984. *Learning How to Learn.* New York: Cambridge University Press.

Novak, J.D. and D. Musonda. 1991. "A Twelve-Year Longitudinal Study of Science Concept Learning." *American Educational Research Journal* Vol. 28: 117-153.

Okebukola, P.A. 1985a. "Effects of Student-Student Interactions on Affective Outcomes of Science Instruction." *Research in Science and Technological Education* Vol. 3, No. 1: 5-17.

Okebukola, P.A. 1985b. "The Relative Effectiveness of Cooperative and Competitive Interaction Techniques in Strengthening Students' Performance in Science Classrooms." *Science Education* Vol. 69: 501-511.

Okebukola, P.A. 1986a. "Cooperative Learning and Students Attitudes to Laboratory Work." *School Science and Mathematics* Vol. 86: 582-590.

Okebukola, P.A. 1986b. "The Influence of Preferred Learning Styles on Cooperative Learning in Science." *Science Education* Vol. 70: 509-518.

Okebukola, P.A. 1986c. "Impact of Extended Cooperative and Competitive Relationships on the Performance of Students in Science." *Human Relations* Vol. 39: 673-682.

Okebukola, P.A. and M.B. Ogunniyi. 1984. "Cooperative, Competitive and Individualistic Laboratory Interaction

Patterns: Effects on Students' Performance and Acquisition of Practical Skills." *Journal of Research in Science Teaching* Vol. 21: 875-884.

Pankratius, W.J. 1990. "Building an Organized Knowledge Base: Concept Mapping and Achievement in Secondary School Physics." *Journal of Research in Science Teaching* Vol. 27: 315-333.

Polya, G. 1945. *How to Solve It*. Garden City, NY: Doubleday.

Purser, R.K. and J.W. Renner. 1983. "Results of Two Tenth-Grade Teaching Procedures." *Science Education* Vol. 67: 85-98.

Ramsden, J. 1992. "If This Is Enjoyable, Is It Science?" *School Science Review* Vol. 73, No. 265: 65-71.

Ramsden, J. 1994. "Context and Activity-Based Science in Action: Some Teachers' Views of the Effects on Pupils." *School Science Review* Vol. 75, No. 272: 7-14.

Reif, F. 1983. "How Can Chemists Teach Problem Solving?" *Journal of Chemical Education* Vol. 60: 948-953.

Reif, F. and J.I. Heller. 1982. "Knowledge Structures and Problem Solving in Physics." *Educational Psychologist* Vol. 17, No. 2: 102-127.

Renner, J., M. Abraham, and H.H. Birnie. 1985. "The Importance of the Form of Student Acquisition of Data in Physics Learning Cycles." *Journal of Research in Science Teaching* Vol. 22: 303-325.

Renner, J., and E. Marek. 1988. *The Learning Cycle and Elementary School Science Teaching*. Portsmouth, NH: Heinemann.

Riley, J.P., II. 1986. "The Effects of Teachers' Wait-Time and Knowledge Comprehension Questioning on Pupil Science Achievement." *Journal of Research in Science Teaching* Vol. 23: 335-342.

Rivers, R. and E. Vockell. 1987. "Computer Simulations to Stimulate Scienctific Problem Solving." *Journal of Research in Science Teaching* Vol. 30: 153-173.

Robertson, W.C. 1990. "Detection of Cognitive Structure with Protocol Data: Predicting Performance on Physics Transfer Problems." *Cognitive Science* Vol. 14: 253-280.

Rogg, S.R. and J.B. Kahle. March 1992. *The Characterization of Small Instructional Work Groups in Ninth-Grade Biology*. Paper presented at the 65th annual meeting of the National Association for Research in Science Teaching (Narst), Boston.

Rosenthal, D.B. 1989. "Two Approaches to STS Education." *Science Education* Vol. 73: 581-589.

Roth, W. 1994. "Student Views of Collaborative Concept Mapping: An Emancipatory Research Project." *Science Education* Vol. 78: 1-34.

Roth, W. and A. Roychoudhury. 1992. "The Social Construction of Scientific Concepts or the Concept Map as Conscription Device and Tool for Social Thinking in High School Science." *Science Education* Vol. 76: 531-557.

Rowe, M.B. 1974a. "Wait-Time and Rewards as Instructional Variables, Their Influence on Language, Logic, and Fate Control: Part I, Fate Control." *Journal of Research in Science Teaching* Vol. 11: 81-94.

Rowe, M.B. 1974b. "Relation of Wait-Time and Rewards to the Development of Language, Logic, and Fate Control: Part II, Rewards." *Journal of Research in Science Teaching* Vol. 11: 291-308.

Rowe, M.B. 1986. "Wait Time: Slowing Down May Be Way of Speeding Up." *Journal of Teacher Education* Vol. 37: 43-50.

Rubba, P.A., M. McGuyer, and T.M. Wahlund. 1991. "The Effects of Infusing STS Vignettes into the Genetics Unit of Biology on Learner Outcomes in STA and Genetics: A Report of Two Investigations." *Journal of Research in Science Education* Vol. 28: 537-552.

Rubin, R.L. and J.T. Norman. March/April 1989. *A Comparison of the Effect of a Systematic Modeling Approach and the Learning Cycle Approach on the Achievement of Integrated Science Process Skills of Urban Middle School Students*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, San Francisco. (ERIC Document Reproduction Service No. Ed 308 838.)

Rubin, R.L. and J.T. Norman. 1992. "Systematic Modeling Versus the Learning Cycle: Comparative Effects on Integrating Science Process Skill Achievement." *Journal of Research in Science Teaching* Vol. 29: 715-727.

Samiroden, W.D. 1983. *The Effects of Higher Cognitive Level Questions Wait Time Ranges by Biology Student Teachers on Student Achievement and Perception of Teacher Effectiveness*. Unpublished doctoral dissertation. Oregon State University.

Savenye, W.C. and E. Strand. 1989. *Teaching Science Using Interactive Videodisc: Results of the Pilot Year Evaluation of the Texas Learning Technology Group Project*. Proceedings of selected research papers presented at the annual meeting of the Association for Educational Communications and Technology. Dallas, TX. (ERIC Document Reproduction Service No. Ed 308 838).

Scharmann, L. March 1992. *Teaching Evolution: The Influence of Peer Instructional Modeling*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Boston.

Schmidt, H. 1990. "Secondary School Students' Strategies in Stoichiometry." *International Journal of Science Education* Vol. 12: 457-471.

Schneider, L.S. and J.W. Renner. 1980. "Concrete and Formal Teaching." *Journal of Research in Science Teaching* Vol. 17: 503-517.

Schoenfeld, A.H. 1978. "Can Heuristics Be Taught?" In *Cognitive Process Instruction*, J. Lochhead and J.J. Clement, editors (pp. 315-338). Philadelphia: Franklin Institute Press.

Sherman, L.W. 1989. "A Comparative Study of Cooperative and Competitive Achievement in Two Secondary Biology Classrooms: The Group Investigative Model Versus an Individually Competitive Goal Structure." *Journal of Research in Science Teaching* Vol. 26: 55-64.

Simmons, P.E. 1989. *Problem Solving Strategies and Approaches of Successful and Unsuccessful Subjects Interacting with a Genetics Computer Simulation*. Paper presented at the annual meeting of the National Association of Research in Science Teaching, San Francisco.

Slavin, R.E. 1980. "Cooperative Learning." *Review of Education Research* Vol. 50: 315-342.

Slavin, R.E. 1984. "Students Motivating Students to Excel: Cooperative Incentives, Cooperative Tasks, and Student Achievement." *The Elementary School Journal* Vol. 85: 53-63.

Slavin, R.E. 1991. "Synthesis of Research on Cooperative Learning." *Educational Leadership* Vol. 48, No. 5: 71-82.

Smith, S.G. and L.L. Jones. 1988. "Images, Imagination, and Chemical Reality." *Journal of Chemical Education* Vol. 66, No. 1: 8-11.

Starr, M. and J. Krajcik. 1990. "Concept Maps as a Heuristic for Science Curriculum Development: Toward Improvement in Process and Product." *Journal of Research in Science Teaching* Vol. 27: 987-1000.

Stavy, R. 1991. "Analogy to Overcome Misconceptions About Conservation of Matter." *Journal of Research in Science Teaching* Vol. 28: 305-313.

Stavy, R. and D. Tirosh. 1993. "When Analogy Is Perceived as Such." *Journal of Research in Science Teaching* Vol. 30: 1229-1239.

Stiff, L.V. 1988. "Problem Solving by Example." *School Science and Mathematics* Vol. 88: 666-675.

Sumfleth, E. 1988. "Knowledge of Terms and Problem-Solving in Chemistry." *International Journal of Science Education* Vol. 10: 45-60.

Sutman, F.X. and M.H. Bruce. 1992. "Chemistry in the Community: A Five Year Evaluation." *Journal of Chemical Education* Vol. 69: 564-567.

Sutula, V. and J.S. Krajcik. September 1988. *The Effective Use of Analogies for Solving Mole Problems in High School Chemistry.* Paper presented at the annual meeting of the National Association of Research in Science Teaching, Lake Ozark, MO.

Sweller, J. 1988. "Cognitive Load During Problem Solving: Effects on Learning." *Cognitive Science* Vol. 12: 257-285.

Thagard, P. 1992. "Analogy, Explanation, and Education." *Journal of Research in Science Teaching* Vol. 29: 537-544.

Thiele, R.B. and D.F. Treagust. 1994. "An Interpretive Examination of High School Chemistry and Teachers' Analogical Explanations." *Journal of Research in Science Teaching* Vol. 31: 227-242.

Tingle, J.B. and R. Good. 1990. "Effects of Cooperative Grouping on Stoichiometric Problem Solving in High School Chemistry." *Journal of Research in Science Teaching* Vol. 27: 671-683.

Tinker, R.F. 1985. "How to Turn Your Computer into a Science Lab." *Classroom Computer Learning* Vol. 5, No. 6: 26-29.

Tobin, K.G. 1985. "The Effect of an Extended Teacher Wait Time on Science Achievement." *Journal of Research in Science Teaching* Vol. 17: 469-475.

Tobin, K.G. 1986. "Effects of Teacher Wait Time on Discourse Characteristics in Mathematics and Language Arts Classes." *American Educational Research Journal* Vol. 32: 191-200.

Tobin, K.G. 1987. "The Role of Wait Time on Higher Level Cognitive Learning." *Review of Educational Research* Vol. 57: 69-95.

Tobin, K.G. and W. Capie. 1982. "Relationships Between Classroom Process Variables and Middle School Science Achievement." *Journal of Educational Psychology* Vol. 14: 441-454.

Treagust, D.F., R. Duit, P. Joslin, and I. Lindauer. 1992. "Science Teachers' Use of Analogies: Observations from Classroom Practice." *International Journal of Science Education* Vol. 14: 413-422.

Van Heuvelen, A. 1991. "Overview, Case Study Physics." *American Journal of Physics* Vol. 59: 898-906.

Waks, L.J. and B.A. Barchi. 1992. "STS in U.S. School Science: Perceptions of Selected Leaders and Their Implications for STS Education." *Science Education* Vol. 76: 79-90.

Wallace, J. and J. Mintzes. 1990. "The Concept Map as a Research Tool: Exploring Conceptual Change in Biology." *Journal of Research in Science Education* Vol. 27: 1033-1052.

Walters, J. 1988. "Teaching Biological Systems." *Journal of Biological Education* Vol. 22: 87.

Ward, C.R. and J.D. Herron. 1980. "Helping Students Understand Formal Chemical Concepts." *Journal of Research in Science Teaching* Vol. 17: 387-400.

Ward, M. and J. Sweller. 1990. "Structuring Effective Worked Examples." *Cognition and Instruction* Vol. 7: 1-39.

Watson, S.B. 1991. "Cooperative Learning and Group Educational Modules: Effects on Cognitive Achievement of High School Biology Students." *Journal of Research in Science Teaching* Vol. 28: 141-146.

Webb, N. 1985. "Student Interaction and Learning in Small Groups: A Research Summary." In *Learning to Cooperate, Cooperating to Learn*, R. Slavin, S. Sharan, K. Spencer, R. Lazarowitz, C. Webb, and R. Schmuck, editors. Leeds: The University of Leeds.

Wells, G. and C. Berger. 1986. "Teacher/Student-Developed Spreadsheet Simulations: A Population Growth Example." *Journal of Computers in Mathematics and Science Teaching* Vol. 42: 34-40.

Westbrook, S.L., L.N. Rogers, and E.A. Marek. April 1990. *An Analysis of the Relationships of Formal Reasoning, Science Process Skills, Gender, and Instructional Treatment to Conceptual Shifts in Tenth Grade Biology Students.* Paper presented at the annual meeting of the National Association for Research in Science Teaching, Atlanta, GA.

White, B.Y. and J.R. Frederickson. 1989. *Designing Articulate Microworlds that Facilitate Learning, Understanding, and Problem Solving in Science Education.* American Educational Research Association: San Francisco.

White, B.Y. and P. Horowitz. 1987. *Thinkertools: Enabling Children to Understand Physical Laws.* Report No. 6470. Cambridge, MA: BBN Laboratories.

White, B.Y. and P. Horowitz. 1988. "Computer Microworlds and Conceptual Change: A New Approach to Science Education." In *Improving Learning: New Perspectives*, P. Ransden, editor (pp. 69-80). London: Kegan Paul.

Willerman, M. and R.A. Mac Harg. 1991. "The Concept Map as an Advance Organizer." *Journal of Research in Science Teaching* Vol. 28: 705-711.

Williamson, V.M. and M.R. Abraham. 1995. "The Effects of Computer Animation on the Particulate Mental Models of College Chemistry Students." *Journal of Research in Science Teaching.*

Wilson, J.M. 1994. "Network Representations of Knowledge About Chemical Equilibrium: Variations with Achievement." *Journal of Research in Science Education* Vol. 31: 1133-1147.

Winther, A.A. and T.L. Volk. 1994. "Comparing Achievement of Inner-City High School Students in Traditional Versus STS-Based Chemistry Courses." *Journal of Chemical Education* Vol. 71: 501-505.

Wise, K.C. 1988. "The Effects of Using Computing Technologies in Science Instruction: A Synthesis of Classroom-Based Research." In *1988 AETSs Yearbook*, J.D. Ellis, editor (pp. 105-118). Columbus: The Ohio State University.

Wiser, M. and D. Kipman. April 1988. *The Differentiation of Heat and Temperature: An Evaluation of the Effect of Microcomputer Models on Students' Misconceptions.* Paper presented at the annual meeting of the American Educational Research Association, New Orleans.

Wong, D.E. 1993a. "Self-Generated Analogies as a Tool for Constructing and Evaluating Explanations of Scientific Phenomena." *Journal of Research in Science Teaching* Vol. 30: 367-380.

Wong, D.E. 1993b. "Understanding the Generative Capacity of Analogies as a Tool for Explanation." *Journal of Research in Science Teaching* Vol. 30: 1259-1272.

Wright, D.S. and C.D. Williams. 1986. "A Wise Strategy for Introductory Physics." *Physics Teacher* Vol. 24: 211-216.

Yager, R.E. and P. Tamir. 1993. "STS Approach: Reasons, Intentions, Accomplishments, and Outcomes." *Science Education* Vol. 77: 637-658.

Yager, R.E., P. Tamir, and N. Mackinnu. 1993. "The Effect of a Science/Technology/Society Approach on Achievement and Attitudes of Students Enrolled in Science Classes in Grades 4 Through 9." Manuscript submitted for publication.

Yager, R.E. and S.O. Yager. 1985. "Changes in Perceptions of Science for Third, Seventh, and Eleventh Grade Students." *Journal of Research in Science Teaching* Vol. 22: 347-358.

Zeitoun, H.H. 1984. "Teaching Scientific Analogies: a Proposed Model." *Research in Science and Technological Education* Vol. 2: 107-125.

Zietsman, A.I. and P.W. Hewson. 1986. "Effect of Instruction Using Microcomputer Simulations and Conceptual Change Strategies on Science Learning." *Journal of Research in Science Teaching* Vol. 23: 27-39.

Zoller, U., J. Ebenezer, K. Morely, S. Paras, V. Sandberg, C. West, T. Wolthers, and S.H. Tan. 1990. "Goal Attainment in Science-Technology-Society S/T/S Education and Reality: The Case of British Columbia." *Science Education* Vol. 74: 19-36.

Chapter 10. Social Studies

James P. Shaver

Social studies has at least two different meanings to those in the field. To some, social studies is a collection of individual courses in U.S. and world history and the social sciences—geography, government, economics, and perhaps sociology, psychology, and anthropology. To others, social studies is a coordinated curriculum that draws on history and the social sciences, as well as other subject areas, with the specific aim of citizenship education. The two definitions are not mutually exclusive, and many social studies teachers identify with both approaches. In any event, this chapter does not presume either definition. The practices suggested to improve student learning are appropriate with either or their combination.

No substantial base of research on the teaching of social studies is available, either in terms of large numbers of cumulative findings or in terms of studies with rigorous designs. It was not possible to say often that "the research clearly indicates...," and in several instances my own professional judgment was the basis for the inclusion of a promising practice. The findings that do exist, along with relevant findings from research in other curriculum areas, have been reviewed and synthesized in the *Handbook of Research on Social Studies Teaching and Learning* (Shaver 1991). I have relied on several of the handbook chapters, along with other literature reviews, in preparing this chapter.

Other than the scarcity of firm, cumulative findings, there is another sense in which the research cannot be interpreted as providing mandates for social studies instruction. Research findings must be applied in specific situations, and can only suggest what ought to be done. Sound instructional decisions must be made in a broader context of district and state guidelines and requirements, the experiences and practical knowledge of the individual teacher and his or her colleagues, and the educational values of the teacher, the school, the school district, and the community. Research can, nevertheless, be a major source of assistance in instructional decision making. Research can stimulate thought and suggest alternatives, providing a significant source of evidence on options as teachers consider how to teach. Skilled, thoughtful, and motivated teachers will then adapt and implement techniques or approaches that research findings suggest will result in high student performance.

It is in the above spirit—that of suggestion, stimulation, even provocation, but not prescription—that this chapter has been prepared. Each teacher is the key to what happens in the classroom, the fundamental determinant of the students' experiences there. Teachers know their students' interests and motivations, their prior experiences, and their expectations, as these will influence students' reactions to instructional techniques and approaches. Each teacher also is aware of the extent to which his or her students find social studies interesting and challenging, and of the extent to which meaningful learning is occurring. This chapter is meant to be helpful to social studies teachers as they contemplate the instruction that will improve their students' interest and learning.

The promising practices suggested in this chapter are interrelated rather than mutually exclusive. For example, jurisprudential teaching can contribute to a thoughtful classroom, as can the teaching of critical thinking. Effective questioning, concept development, and establishing a positive classroom environment should pervade all instruction. The practices are not presented to be chosen among, but as potential contributors to that complexity of interactions that, over time, constitutes effective social studies instruction.

References: Shaver 1979, 1987, 1991.

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10.1. Thoughtful Classrooms: Students taught in thoughtful classrooms, with atmospheres that promote higher-order thinking, will find social studies to be challenging and engaging.

Research findings:

An extensive body of literature supports the contributions to motivation and learning when students are engaged in higher-order thinking. Moreover, the development of higher-order thinking is an important element in social studies citizenship education. The emerging standards in history, civics and government, and social studies stress the importance of higher-order thinking outcomes such as analysis, interpretation, and value-conflict resolution.

Thoughtful classrooms counter the lack of student interest in social studies that research indicates is prevalent. The six characteristics of thoughtful classrooms (see below) were used to rate social studies lessons in five high schools; 45 students were interviewed and administered questionnaires. Forty-two percent of the students in thoughtful social studies classrooms reported that social studies was their most interesting and worthwhile subject, and over 35 percent of those students said that social studies was their most challenging subject.

In the classroom:

In thoughtful classrooms, students are engaged in higher-order thinking as questions or problems are posed that cannot be dealt with through the routine application of knowledge already learned. Based on an extensive review of the literature, Newmann proposed six characteristics of thoughtful classrooms:

- The in-depth, sustained study of a small number of topics is the mode, not the superficial coverage of many topics.
- Lessons are not fragmented, but each has coherence and continuity, with the parts logically related to the development of one or a few ideas.
- Students are given time to think about their responses during discussions.
- The teacher asks questions or structures tasks that are appropriate for the students' ability and background, and challenging because they call for analysis and interpretation, rather than recall and repetition.
- The teacher models thoughtfulness by revealing how he or she thinks through problems such as those under consideration, acknowledging when a definitive answer is not attainable, and recognizing and respecting alternative approaches, especially the students', to solving problems.
- Students are encouraged and helped to go beyond stating conclusions to the explication and explanation of their reasoning.

In observations of thoughtful classrooms, Newmann found that a) the teacher responded carefully to the quality of the students' reasons for their ideas and conclusions; b) the teacher often used Socratic-type questioning; and c) primary sources were often used, with less reliance on textbooks.

References:

Center for Civic Education 1994; Marker and Mehlinger 1992; National Center for History in the Schools 1994, n.d.; National Council for the Social Studies 1994; Newmann 1990a, 1990b, 1991; Parker 1991; Schug, Todd, and Beery 1984; Shaughnessy and Haladyna 1985; Stevenson 1990; Walsh and Paul 1987.

10.2. Jurisprudential Teaching: Students taught with the jurisprudential approach will gain skills in the analysis of contemporary issues, have greater interest in those issues, and learn as much or more social studies content as students taught in a more traditional manner.

Research findings:

In jurisprudential teaching, students are involved in the in-depth consideration of public policy issues and issues of personal citizenship behavior. Jurisprudential teaching is based on a model that includes several elements:

- A recognition that controversy over public issues is inevitable because the persons involved bring differing frames of reference, stemming from their different backgrounds (for example, ethnic, gender, geographic, religious, socio-economic, familial, urban-rural).
- A conception of values (standards or principles for judging worth) as fundamental elements in each person's frame of reference that conflict with one another (for example, honesty versus compassion) and that underlie public controversy as persons with differing frames of reference define and weigh common values differently (for example, in defining and prioritizing property rights and environmental responsibility in developing and enforcing zoning laws).
- An analytic frame for analyzing public issues that encompasses the need to:
    - — be conscious of differing frames of reference;
    - — clarify language, including cognitive meanings and emotive loadings;
    - — determine and validate relevant facts;
    - — identify, define, and weigh relevant values; and
    - — come to a decision that takes into account language problems, factual uncertainties, and value discordance.
- A pedagogical approach that involves intensive dialogue among teachers and students based on specific cases, their historical and social contexts, and their implications for policy.

Research on the jurisprudential approach has included investigation of a two-year U.S. history sequence taught to seventh and eighth graders using a jurisprudential framework and investigation of a three-year social studies sequence at the high school level. Outcomes for the experimental students were compared against those for control students in the same school and in other schools. The results indicated that the experimental students used appropriate analytic concepts more frequently in considering and in discussing public issues; on average gained as much knowledge of social studies content as did the control students, but more historical knowledge when it was studied both in the regular curriculum and as part of an issues unit; and had higher interest in societal issues, especially in areas of controversy that had not been studied.

The use of jurisprudential teaching is supported by the new national standards in social studies and related areas. The national standards for civics and government emphasize that students should learn the intellectual skills necessary to analyze public issues critically, so as to be able to evaluate the positions of others and take and define their own positions. Included is the need to understand and deal with conflicts between values. The standards for United States history and world history also emphasize the analysis of value-laden social issues. In addition, the social studies curriculum standards stress that students should learn to deal with difficult choices about issues that involve value conflicts.

In the classroom:

The systematic identification of issues, gathering of background information, and analysis of definitional, factual, and value questions in arriving at a justified policy decision is at the core of jurisprudential teaching. Whether discussions should involve intense confrontational interchanges or the dispersion of non-emotive questions among class members is a decision for the individual teacher, based on his or her own strengths and preferences and those of the students.

A helpful overview of jurisprudential teaching and a discussion of specific instructional steps is available in Joyce and Weil's *Models of Teaching*. Joyce and Weil focus their attention on a confrontational, Socratic type of jurisprudential discussion; however, Socratic questioning is not a *sine qua non* of jurisprudential teaching. Recitation discussion can be equally effective.

Jurisprudential teaching is applicable to both contemporary and historical issues. The popularity of the jurisprudential approach has been due in part to the availability of short units that can be interspersed in history courses. Updated unit booklets are available from the Social Science Education Consortium on a number of topics—immigration, the American Revolution, the Civil War, the progressive era and the railroad era, the New Deal, organized labor, religious freedom, and science and public policy. In addition, materials produced by Lockwood and Harris for teaching ethical issues in history are helpful. Brief historical cases, such as John Adams' decision to defend the British soldiers after the Boston Massacre, are presented along with questions to help students review facts and analyze the ethical issues involved. An outline of concepts for analyzing public issues and suggestions for teaching them were developed by Shaver and Larkins. The concepts encompass psychological and semantic effects on reasoning about public issues; handling factual, definitional, and value disputes; and arriving at a qualified decision that takes into account the assumptions being made and conditions under which the decision would be changed. Materials for concept development and suggestions for their use are provided, along with public issues cases for concept application.

References:

Center for Civic Education 1994; Joyce and Weil 1986; Lockwood and Harris 1985a, 1985b; National Center for History in the Schools 1994, n.d.; National Council for the Social Studies 1994; Oliver and Shaver 1966/1974; Parker 1991; Shaver and Larkins 1973.

Social Science Education Consortium booklets: Giese 1989; Giese and Glade 1988; Glade and Giese 1989; Greenawald 1991; Schott 1991; Singleton 1989, 1990, 1993; Stewart and Giese 1989.

10.3. Appropriate Classroom Environment: When social studies teachers establish appropriate classroom environments, their students will have more positive attitudes toward social studies and will develop more positive political attitudes.

Research findings:

Surveys and interviews of students have repeatedly established both the lack of student interest in social studies and the lack of social studies effects on political knowledge and attitudes. The research on classroom environment, or climate, and attitudes toward social studies and political attitudes is largely correlational, but has involved grade school, middle school, and high school students. Reviewers such as Hahn, Leming, and Patrick and Hoge have pointed out that strategies like those discussed below are based on consistent, if not strong, research findings.

In the classroom:

The research indicating students' lack of interest in social studies is of serious concern, as is the evidence indicating that social studies courses often have little effect on students' political attitudes and behavior. Establishing an appropriate classroom environment (sometimes referred to as *climate*) can help to counter student apathy toward social studies and improve students' political attitudes.

Environmental factors under the teacher's control that have been shown to improve attitudes toward social studies include:

- the provision of clear expectations and rules for classroom behavior and consistency in dealing with rule infractions;
- the use of diverse teaching strategies and new techniques and avoiding repetitious classroom routines;
- teaching techniques that actively involve students in lessons, such as group research projects on civil rights issues in which students interview community members and discuss the results in class;
- cooperative learning activities;
- positive and supportive communication with students.

When controversial issues are discussed, it is important to establish an open environment, or climate, in which:

- students feel free to express their opinions;
- students feel that they are respected and their opinions valued;
- a wide range of views are expressed;
- the teacher does not take strong, one-sided stands on issues, but encourages rational discussion and disagreement.

References:

Angell 1991; Fouts 1987, 1989; Hahn 1991; Haladyna, Shaughnessy, and Redsun 1982; Harwood 1992; Johnson and Johnson 1979; Leming 1985; Marker and Mehlinger 1992; Patrick and Hoge 1991; Schug, Todd, and Beery 1984; Shaughnessy and Haladyna 1985; Shaver 1987; Shaver, Davis, and Helburn 1979.

10.4. Teaching Critical Thinking: Students will better learn and use critical thinking skills and strategies if these skills and strategies are taught explicitly in the context of content knowledge and with attention to their appropriate applications.

Research findings:

Research reviews over more than 30 years have attested to a growing body of knowledge about teaching students to think critically. The importance of teaching critical thinking skills is affirmed by the emerging standards in civics and government, geography, history, and social studies.

It is clear that students can learn critical thinking skills and strategies appropriate to social studies—if they are taught explicitly. The evidence on the relationship between students' content knowledge and the learning and application of critical thinking skills is less clear, especially in regard to the most effective mix of in-depth knowledge and specific skills instruction. The efficacy of metacognition—the self-monitoring of one's own thinking activity—in learning is well-established, but less is known about how to teach students to engage in metacognition.

In the classroom:

Students will typically not learn to think critically as an indirect result of exposure to the thinking of others. The critical thinking concepts, skills, and strategies to be learned must be identified and taught explicitly. Direct instruction and guided application are necessary.

For instruction to be effective, the critical thinking skills and strategies to be learned must be appropriate to the types of problems and issues the students are to confront and must be taught in a substantive context. For example, the adequate consideration of public issues requires the identification and analysis of ethical issues (questions or proper aims and actions), typically not part of instruction in social science or history. And meaningful application of ethical-issues skills will depend on adequate historical and social science knowledge about the public issue under consideration.

Students must also be helped to reflect on the functions of the critical thinking skills and strategies, and learn to ask themselves questions about how appropriately and adequately they are applying the skills, rather than relying on the teacher to do so. The encouragement of such metacognition—that is, thinking about thinking—requires several steps. Students must:

- be helped to explicitly conceptualize and verbalize thinking skills and strategies;
- learn to recognize types of problems to which the skills can be applied;
- be involved in the collaborative consideration of the appropriateness with which the skills are being applied during discussions or in their writing; and
- observe the teacher modeling self-thought about the processes and concepts used to grapple with issues (that is, the teacher should think aloud as she or he grapples with the definition of a problem and the identification and application of an approach or approaches to solving it).

References:

Center for Civic Education 1994; Cornbleth 1985; Geography Education Standards Project 1994; National Center for History in the Schools 1994, n.d.; National Council for the Social Studies 1994; Oliver and Shaver 1966/1974; Parker 1991; Shaver 1962.

10.5. Support for Concept Development: Students will develop more adequate concepts when instruction includes appropriate definitions, examples and non-examples of critical elements, exploration of relations to other concepts, and attention to the students' prior knowledge.

Research findings:

The development of valid concepts (categories for grouping and understanding phenomena) has been the subject of extensive experimental research for the last 25 years or so, but only a limited number of studies have been explicitly in social studies. Synopses of the implications for social studies in the research reviews by Martorella and by Stanley and Mathews are particularly helpful to persons interested in a sound, empirical basis for concept instruction. The central place of concept development in social studies education is supported by the emphasis on knowledge and concepts in the recent statements of national standards.

In the classroom:

Concept development is a central concern in social studies. Instruction should be carefully planned, beginning with the identification of the concept's critical attributes, including whether the concept has a relatively simple, fixed, concrete meaning (such as "arable land") or has a complex, shifting, abstract meaning (such as "ethnicity"). Several instructional steps will promote valid concept development and use:

- Present examples and nonexamples of the concept in a logical order that expands on the intended meaning, culminating with one best example, if possible.
- Cue students to the critical attributes illustrated by the examples and nonexamples with questions, directions, and activities that not only draw attention to the attributes but help the students to focus on the similarities among the examples and their dissimilarities with the nonexamples.
- Provide the students with evaluations of their efforts to identify the critical attributes illustrated by the examples and nonexamples.
- If the concept has a clear, fixed definition, either state it for the students or help them to enunciate it, as an introduction to and/or summary of the lesson.
- If the concept's meaning is complex, with multiple, abstract, and/or not clearly identifiable critical elements, specifically tell the students that the concept has fuzzy boundaries and help the students identify salient features through consideration of a few best examples.
- With complex concepts, during discussions specifically tell the students which of the possible definitions you are using.
- Help the students, through discourse or questions, to relate the concept being developed to concepts already part of their knowledge.
- Assess the students' comprehension by asking questions to determine if they can correctly determine the applicability of new examples and nonexamples and, if they can, whether they can think of new examples and apply the concept to new situations.

References:

Center for Civic Education 1994; Geography Education Standards Project 1994; Martorella 1990, 1991; National Center for History in the Schools 1994, n.d.; National Council for the Social Studies 1994; Stanley and Mathews 1985.

10.6. Effective Questioning: The appropriate phrasing, pacing, and distribution of questions and responses to student answers will enhance student learning in social studies.

Research findings:

Recitation discussions are a central feature of social studies instruction. How they are conducted can make the difference between bored students who learn little and motivated students who achieve both lower-level and higher-level cognitive outcomes.

There is a substantial body of research on types and frequency of teacher questions, but fewer studies that have investigated the linkages between teacher questions and student achievement. Nevertheless, some clear guidelines for effective questioning have emerged. Brophy and Good and Wilen and White have written excellent reviews of the research.

In the classroom:

Effective questioning begins with asking questions that are appropriate to the students' cognitive level and prior knowledge. Most questions should be phrased to elicit a correct response. Contrary to what is often assumed, questions at a predominately lower cognitive level can also promote higher-level achievement, if they are logically structured to lead to that outcome. A high frequency of questions, briskly paced, can maximize student achievement, especially with lower socioeconomic status students.

The clarity of the questions asked is crucial. If questions are unclear, it is difficult for students to respond correctly. Clarity is increased by avoiding the use of vague terms; asking one question at a time; not punctuating questions with false starts; and avoiding redundancies, tangled words, irrelevant content, and interjections such as "uh."

It is important that all students participate. Volunteer and nonvolunteer contributions should be balanced at all grade levels; nonvolunteers who probably know the answer or have a contribution to make should be called on, but in an unpredictable pattern. Students should be expected to respond to all teacher questions, even if only to say, "I don't know."

Teachers should wait—about 3-5 seconds—after posing a question. Wait time increases achievement by giving students a chance to decide whether to respond, to organize an answer, or to ask for clarification.

Praise should be used sparingly in reacting to student responses. The acknowledgment of a correct answer is usually sufficient reinforcement, and overuse trivializes commendation. If an answer is partly correct, the correct part should be affirmed and the question rephrased or follow-up clues given to elicit a fully correct response. Appropriate responses to an incorrect answer include: a) simply saying it is not right, avoiding personal criticism unless it is called for because the student has been inattentive or is unprepared; b) rephrasing or breaking down the question or providing clues to elicit a better response (but avoiding "hammering" a confused or anxious student with a series of follow-up questions); or c) explaining why the answer is incorrect or how a correct answer could be derived from the available information.

References:

Brophy and Good 1986; Wilen and White 1991.

10.7. Cognitive Prejudice Reduction: Increasing students' cognitive sophistication through emphasis on sound knowledge about other groups and on reasoning skills for drawing valid inferences about group differences can help reduce prejudice.

Research findings:

Reviews of research indicate that persons who lack cognitive sophistication and think in either-or terms are more likely to be prejudiced against minority groups; conversely, those who learn to avoid over-generalizations and stereotypical thinking are less likely to be prejudiced. Nine surveys by the *University of California Research Program on Patterns of American Prejudice*, including personal interviews of a national probability sample by the National Opinion Research Center at the University of Chicago, provided strong evidence that there is a cognitive basis for prejudice in lack of knowledge, poor reasoning skills, and shallow commitment to basic democratic norms and values. Research indicates that if individuals are helped to confront inconsistencies in their applications of fundamental values to minority groups, they tend to develop more positive attitudes.

The civics and government national standards and the social studies national standards emphasize the importance of students' commitment to and comprehension of basic democratic values, the role of diversity in a democratic society, and reduction in unfair discrimination against those who are different.

In the classroom:

A cognitive approach to prejudice reduction is an effective complement to elementary teachers' efforts to improve children's self-esteem and develop empathy through fostering positive social interactions among children from different groups. Effective techniques for promoting positive attitudes toward those who are different include contact in cooperative learning groups and simulation situations where prejudice is evoked. These approaches to prejudice reduction are also applicable with older students; however, the cognitive approach fits particularly well with the academic orientation of secondary-school social studies courses.

Elements in a cognitive approach to prejudice reduction include the following:

- Provide students with sound knowledge about minorities, including the nature and extent of actual group differences and their roots in social and economic history.
- Deal directly with prejudice as a concept, including its basis in partial truths, the negative effects of belief in and actions based on unsound prejudgments, and how to detect prejudice in oneself and others.
- Develop students' skills in evidence evaluation and logical inference, especially as these apply to caution in drawing conclusions from statements by others about minority groups, from known group differences, and from individual incidents or encounters experienced by the students.
- Develop the students' understanding of the nature of democracy and the meanings and implications of basic values such as human worth and dignity, equality, freedom of speech and religion, and the importance of diversity, and help students to apply basic values in evaluating their own behavior and that of others.

- Challenge the students to examine their own assumptions and beliefs about persons in other groups, based on sound knowledge, thinking skills, and basic human values.

References:

Banks 1992; Byrnes 1988; Byrnes and Kiger 1992; Center for Civic Education 1994; Curtis 1991; National Council for the Social Studies 1994; Pate 1988; Quinley and Glock 1983; Rokeach 1973.

10.8. Computer Databases and Simulations: Student use of computer databases and simulations in social studies can increase motivation and interest, as well as higher-order thinking skills.

Research findings:

The research evidence on the use of computers in social studies instruction is sparse, and much of it is anecdotal and impressionistic. Even with better-designed quantitative or qualitative studies, making teaching recommendations will likely continue to be hazardous because the technology and available software change so rapidly that generalization is difficult.

To this point, there is little consistent evidence that use of computer databases and simulations increases students' information recall. There is some evidence that, with adequate teacher structuring, computers can be used to help students develop problem-solving skills. What is clear is that use of computer databases and simulations tends to increase students' interest in the subject matter, their enjoyment of and perseverance in their social studies work, and their sense of control over their own learning.

It is also clear that interactive technology cannot produce results in a vacuum. The use of computer databases and simulations will not automatically produce better learning outcomes than the use of other instructional tools, such as textbooks. The sound structuring of experiences based on valid objectives remains crucial. The teacher remains the key to an effective learning situation.

In the classroom:

Computer databases can be used to help students learn to obtain, manipulate, and interpret data; computer simulations can help students comprehend the complexity of policy decisions. The development of computers and other interactive technologies for classroom use is occurring so rapidly, with hardware and software continuously superseded by new models and versions, that it is difficult to summarize possible social studies applications. As the interactive capabilities of hardware are enhanced, with striking increases in storage capacity and processing speed, the potential contributions to social studies learning will be heightened.

Teachers often lack the time or expertise necessary to plan, design, enter data and programs, and then run trials in order to develop databases and simulations, and are forced to use or modify commercial software. Nevertheless, the use of computer databases and simulations does not diminish the teacher's role as instructional leader. Even with a commercial product, the teacher must structure the learning situation, based on thorough subject-area knowledge and analysis of the adequacy of the content of the software, the interactive capabilities of the computers being used, and the appropriate place for computer activities in the instructional unit. In addition, the teacher must determine whether students have the computer skills necessary to access the database information or engage in the simulation, and whether their subject-matter knowledge is sufficient for the computer activities to be meaningful.

The software must be examined for appropriateness. If the access and interactive instructions are too sparse or complex for the students, confusion, frustration, and loss of valuable instruction time will be the result. If the students lack sufficient knowledge about the content area, they will have difficulty formulating the problems to be explored with the database or during the simulation, or they will be unable to understand the problems presented via the software. Similarly, students must understand the database categories and comprehend the simulation context and the players' roles if their computer use is to be meaningful and productive.

With computers, regular, often daily teacher guidance has been found to be more effective than unit-end activities. Helpful activities include group debriefings, requiring interim written products with teacher checks of those products, the clear evaluation of student progress, and suggestions by the teacher for next steps in data use or simulation procedures.

Cooperative learning has been found to be an effective complement to the use of interactive technology, especially when a computer is not available for every student in the class.

References:

Clark 1983; Clegg 1991; Ehman and Glenn 1991; Ehman et al. 1992.

10.9. Student Participation in the Community: Students who participate actively in the local community as part of the social studies curriculum, performing tasks with real consequences, tend to have a greater sense of social responsibility, increased moral development, enhanced self-esteem, more positive attitudes toward adults, and improved skills and knowledge directly related to the experience.

Research findings:

The evidence on the positive outcomes of community participation as part of the social studies curriculum is tentative. Although a few large studies have been carried out, the difficulties of research control in such settings are great and the results have generally been small for outcomes such as moral development, anticipated political involvement, self-esteem, thinking skills, and knowledge.

Nevertheless, in every study the consensus of the participants—not only the students, but those with whom they worked in the community, their parents, and their teachers—was that community participation is a powerful learning experience that, if structured properly, can be enjoyable and worthwhile.

In the classroom:

The active participation of students in the social and political life of the community gives them opportunities to apply what they have learned and lays a basis for further learning in social studies. Although such real-life involvement fits well with assumptions about how people learn, community participation has not had widespread application in social studies. Programs that have been tried range from public service (such as volunteering in a nursing home or tutoring disadvantaged peers or illiterate adults) to involvement in the political arena (such as serving an internship with a city or county official). In successful programs, the students are not the recipients of services; rather, they perform tasks that they and the community believe are worthwhile and that have observable real-life outcomes, in contrast with most in-class activities.

Community participation is likely to have the greatest effect when the duration is fairly long, for example, a semester or more, and when times are scheduled for the students to meet with other students and teachers or other adults to reflect on the experience. However, the specific nature of community participation programs varies greatly, and students' individual experiences have been found to account for more student learning and growth than do general program characteristics. Among the program elements that students have reported as leading to significant experiences are: the freedom to follow personal interests; being allowed to assume adult responsibility for carrying out activities; minimal adult supervision that takes place without negative critiques; the development of personal relationships in the community setting; and the opportunity to discuss the ongoing experience regularly with a knowledgeable, supportive teacher.

References:

Conrad 1991; Leming 1985; Newmann 1975; Schug and Beery 1984.

10.10. Constructivist Teaching: When students are involved in actively constructing their knowledge, with teacher guidance based on understanding of the subject matter and the conceptions and misconceptions that the students bring to the learning situation, learning will be both more meaningful and correct.

Research findings:

A constructivist approach to teaching social studies rests on the assumption that meaning, knowledge, or ideas cannot simply be conveyed to students through lectures or reading about a subject-matter area. Individuals construct their own meanings, ideas, and knowledge, and teachers must recognize and guide that process or inaccurate knowledge or lack of new learning will result. In constructivist teaching, students are given ample opportunities to explore ideas, to think out loud, to develop and share hypotheses, to test their hypotheses and discuss alternative explanations of observed or read-about phenomena, and to revise their thinking in a supportive context.

Constructivist teaching has a solid foundation in the research findings of cognitive psychologists since the 1960s. Much earlier, John Dewey had clearly articulated the thesis that ideas cannot just be conveyed from one person to another, but must be developed by individuals as they face quandaries and dilemmas and seek to resolve them based on their own experiences. Most of the recent research has been in science and mathematics education, where researchers were initially surprised by the tenacity of students' "naive" or incorrect beliefs. Nevertheless, the research seems clearly applicable to social studies instruction, whether aimed at teaching social science and historical knowledge or the analysis of public issues.

In the classroom:

The teacher must play an active role in a constructivist classroom. The first step is to decide on the basic ideas, knowledge, and skills to be pursued. Then the teacher must determine the students' prior knowledge, not only as a base for further learning, but also for the prior misunderstandings that might interfere with learning new concepts or developing new knowledge correctly. Students, for example, may have serious misconceptions about other ethnic groups that will interfere with learning about the dynamics of prejudice or the factors to take into account in debates of public policy.

Once prior knowledge is assessed and misconceptions identified, the teacher's challenge is to:

- present the phenomenon under study accurately, relating it to the students' own prior experiences, sometimes through analogy and metaphor (for example, relating the basic value, "equality of opportunity," to "fairness" in playground team selection);
- engage students in activities (such as Socratic discussions or reading provocative literature) that make them aware of erroneous thinking or inconsistencies in their thinking; and
- propose new ways of viewing the phenomenon (that is, of constructing new schemata) that are not only correct but also meaningful to students (often eliciting the "Oh, now I see!" reaction).

Throughout, it is crucial to remember that the students' cognitive constructions have been functional and will be resistant to change, whether to become more accurate or more complex. New and accurate meanings that are durable are not likely to be developed quickly in a one-day lesson. The construction of new meanings that become a part of one's everyday thought occurs over time, with repeated opportunities to think actively about the subject. Writing assignments and tests that call for thoughtful analysis and synthesis, not repetition of memorized bits of information, facilitate the construction process.

References:

Dewey 1933; Resnick 1983, 1987; Saunders 1992; Shaver 1977.

References

Angell, A.V. 1991. "Democratic Climates in Elementary Classrooms: A Review of Theory and Research." *Theory and Research in Social Education* Vol. 19: 241-266.

Banks, J.A. 1992. "Reducing Prejudice in Children: Guidelines from Research." *Social Studies and the Young Learner* Vol. 5: 3-5.

Brophy, J. and T.L. Good. 1986. "Teacher Behavior and Student Achievement." In *Handbook of Research on Teaching* (3rd Edition), M.C. Wittrock, editor (pp. 328-375). New York: Macmillan.

Byrnes, D.A. 1988. "Children and Prejudice." *Social Education* Vol. 52: 267-271.

Byrnes, D.A. and G. Kiger, editors. 1992. *Common Bonds: Anti-Bias Teaching in a Diverse Society.* Wheaton, MD: Association for Childhood Education International.

Center for Civic Education. 1994. *National Standards for Civics and Government.* Calabasas, CA: Center for Civic Education.

Clark, R.E. 1983. "Reconsidering Research on Learning from Media." *Review of Educational Research* Vol. 53: 445-459.

Clegg, A.A., Jr. 1991. "Games and Simulations in Social Studies Education." In *Handbook of Research on Social Studies Teaching and Learning*, J.P. Shaver, editor (pp. 523-529). New York: Macmillan.

Conrad, D. 1991. "School-Community Participation for Social Studies." In *Handbook of Research on Social Studies Teaching and Learning*, J.P. Shaver, editor (pp. 540-548). New York: Macmillan.

Cornbleth, C. 1985. "Critical Thinking and Cognitive Processes." In *Review of Research in Social Studies Education: 1976-1983*, W.B. Stanley, editor (pp. 11-63). Washington, DC: National Council for the Social Studies.

Curtis, C.K. 1991. "Social Studies for Students At-Risk and with Disabilities." In *Handbook of Research on Social Studies Teaching and Learning*, J.P. Shaver, editor (pp. 157-174). New York: Macmillan.

Dewey, J. 1933. *How We Think.* Boston: D.C. Heath.

Ehman, L.H. and A.D. Glenn. 1991. "Interactive Technology in Social Studies." In *Handbook of Research on Social Studies Teaching and Learning*, J.P. Shaver, editor (pp. 513-522). New York: Macmillan.

Ehman, L.H., A.D. Glenn, V. Johnson, and C.S. White. 1992. "Using Computer Databases in Student Problem Solving: A Study of Eight Social Studies Teachers' Classrooms." *Theory and Research in Social Education* Vol. 20: 179-206.

Fouts, J.T. 1987. "High School Social Studies Classroom Environments and Attitudes: A Cluster Analysis Approach." *Theory and Research in Social Education* Vol. 15: 105-114.

Fouts, J.T. 1989. "Classroom Environments and Student Views of Social Studies: The Middle Grades." *Theory and Research in Social Education* Vol. 17: 136-147.

Geography Education Standards Project. 1994. *Geography for Life: National Geography Standards 1994.* Washington, DC: National Geographic Society.

Giese, J.R. 1989. *The Progressive Era: The Limits of Reform.* Boulder, CO: Social Science Education Consortium.

Giese, J.R. and M.E. Glade. 1988. *American Revolution: Crisis of Law and Change.* Boulder, CO: Social Science Education Consortium.

Glade, M.E. and J.R. Giese. 1989. *Immigration, Pluralism and National Identity.* Boulder, CO: Social Science Education Consortium.

Greenawald, G.D. 1991. *The Railroad Era: Business Competition and the Public Interest.* Boulder, CO: Social Science Education Consortium.

Hahn, C.L. 1991. "Controversial Issues in Social Studies." In *Handbook of Research on Social Studies Teaching and Learning*, J.P. Shaver, editor (pp. 470-480). New York: Macmillan.

Haladyna, T.M., J. Shaughnessy, and A. Redsun. 1982. "Correlates of Attitudes Toward Social Studies." *Theory and Research in Social Education* Vol. 10: 1-26.

Harwood, A.M. 1992. "Classroom Climate and Civic Education in Secondary Social Studies Research: Antecedents and Findings." *Theory and Research in Social Education* Vol. 20: 47-86.

Johnson, D.W. and R.T. Johnson. 1979. "Conflict in the Classroom: Controversy and Learning." *Review of Educational Research* Vol. 49: 51-70.

Joyce, B. and M. Weil. 1986. *Models of Teaching* (3rd Edition). Englewood Cliffs, NJ: Prentice-Hall.

Leming, J.S. 1985. "Research on Social Studies Curriculum and Instruction: Interventions and Outcomes in the Socio-Moral Domain." In *Review of Research in Social Studies Education: 1976-1982*, W.B. Stanley, editor (pp. 123-213). Washington, DC: National Council for the Social Studies.

Lockwood, A.L., and D.E. Harris. 1985a. *Reasoning with Democratic Values: Ethical Problems in United States History, Volume 1: 1607-1876.* New York: Teachers College Press.

Lockwood, A.L. and D.E. Harris. 1985b. *Reasoning with Democratic Values: Ethical Problems in United States History, Volume 2: 1877 to the Present.* New York: Teachers College Press.

Marker, G. and H. Mehlinger. 1992. "Social Studies." In *Handbook of Research on Curriculum*, P.W. Jackson, editor (pp. 830-851). New York: Macmillan.

Martorella, P.H. 1990. "Teaching Concepts." In *Classroom Teaching Skills* (4th Edition), J.M. Cooper, editor. Lexington, MA: D.C. Heath.

Martorella, P.H. 1991. "Knowledge and Concept Development in Social Studies." In *Handbook of Research on Social Studies Teaching and Learning*, J.P. Shaver, editor (pp. 370-384). New York: Macmillan.

National Center for History in the Schools. (n.d.). *National Standards for United States History: Exploring the*

American Experience. Los Angeles: University of California, Los Angeles.

National Center for History in the Schools. 1994. *National Standards for World History: Exploring Paths to the Present*. Los Angeles: University of California, Los Angeles.

National Council for the Social Studies. 1994. *Expectations of Excellence: Curriculum Standards for Social Studies*. Washington, DC: NCSS.

Newmann, F.M. 1975. *Education for Citizen Action: Challenge for Secondary Education*. Berkeley, CA: McCutchan.

Newmann, F.M. 1990a. "Higher Order Thinking in Social Studies: A Rationale for the Assessment of Classroom Thoughtfulness." *Journal of Curriculum Studies* Vol. 22: 41-56.

Newmann, F.M. 1990b. "Qualities of Thoughtful Social Studies Classes: An Empirical Profile." *Journal of Curriculum Studies* Vol. 22: 253-275.

Newmann, F.M. 1991. "Promoting Higher Order Thinking in Social Studies: Overview of a Study of Sixteen High School Departments." *Theory and Research in Social Education* Vol. 19: 324-340.

Oliver, D.W. and J.P. Shaver. 1974. *Teaching Public Issues in the High School*. Logan, UT: Utah State University Press. (Original work published 1966.)

Parker, W.C. 1991. "Achieving Thinking and Decision-Making Objectives in Social Studies." In *Handbook of Research on Social Studies Teaching and Learning*, J.P. Shaver, editor (pp. 345-356). New York: Macmillan.

Pate, G.S. 1988. "Research on Reducing Prejudice." *Social Education* Vol. 52: 287-289.

Patrick, J.J., and J.D. Hoge. 1991. "Teaching Government, Civics, and Law." In *Handbook of Research on Social Studies Teaching and Learning*, J.P. Shaver, editor (pp. 427-436). New York: Macmillan.

Quinley, H.E. and C.Y. Glock. 1983. *Anti-Semitism in America*. New Brunswick, NJ: Transaction Books.

Resnick, L.B. 1983. "Mathematics and Science Learning: A New Conception." *Science* Vol. 220: 470-478

Resnick, L.B. 1987. *Education and Learning to Think*. Washington, DC: National Academy Press.

Rokeach, M. 1973. *The Nature of Human Values*. New York: The Free Press.

Saunders, W.L. 1992. "The Constructivist Perspective: Implications and Teaching Strategies for Science." *School Science and Mathematics* Vol. 92, No. 3: 136-141.

Schott, J.C. 1991. *Religious Freedom: Belief, Practice, and the Public Interest*. Boulder, CO: Social Science Education Consortium.

Schug, M.C. and R. Beery. 1984. *Community Study: Applications and Opportunities*. Washington, DC: National Council for the Social Studies.

Schug, M.C., R.J. Todd, and R. Beery. 1984. "Why Kids Don't Like Social Studies." *Social Education* Vol. 48: 382-387.

Shaughnessy, J. and T.M. Haladyna. 1985. "Research on Student Attitude Toward Social Studies." *Social Education* Vol 49: 692-695.

Shaver, J.P. 1962. "Educational Research and Instruction for Critical Thinking." *Social Education* Vol. 26: 13-16.

Shaver, J.P. 1977. "Needed: A Deweyean Rationale for Social Studies." *The High School Journal* Vol. 60, No. 8: 345-352.

Shaver, J.P. 1979. "The Usefulness of Educational Research in Curricular/Instructional Decision-Making in Social Studies." *Theory and Research in Social Education* Vol. 7, No. 3: 21-46.

Shaver, J.P. 1987. "Implications from Research: What Should Be Taught in Social Studies?" In *Educators' Handbook: A Research Perspective*, V. Richardson-Koehler, editor (pp. 112-138). New York: Longman.

Shaver, J.P., editor. 1991. *Handbook of Research on Social Studies Teaching and Learning*. New York: Macmillan.

Shaver, J.P. and A.G. Larkins. 1973. *The Analysis of Public Issues Programs*. Boston, MA: Houghton Mifflin.

Shaver, J.P., O.L. Davis, and S.W. Helburn. 1979. "The Status of Social Studies Education: Impressions from Three NSF Studies." *Social Education* Vol. 43, No. 2:, 150-153.

Singleton, L.R. 1989. *The Civil War: Slavery and the Crisis of Union*. Boulder, CO: Social Science Education Consortium.

Singleton, L.R. 1990. *The New Deal: Government and the Economy*. Boulder, CO: Social Science Education Consortium.

Singleton, L.R. 1993. *Science and Public Policy: Uses and Control of Knowledge*. Boulder, CO: Social Science Education Consortium.

Stanley, W.B. and R.C. Mathews. 1985. "Recent Research on Concept Learning: Implications for Social Education." *Theory and Research in Social Education* Vol. 12: 57-74.

Stevenson, R.B. 1990. "Engagement and Cognitive Challenge in Thoughtful Social Studies Classes: A Study of Student Perspectives." *Journal of Curriculum Studies* Vol. 22: 329-341.

Stewart, J. and J.R. Giese. 1989. *The Rise of Organized Labor: Workers, Employers, and the Public Interest*. Boulder, CO: Social Science Education Consortium.

Walsh, D. and R.W. Paul. 1987. *The Goal of Critical Thinking: From Educational Ideal to Educational Reality*. Washington, DC: American Federation of Teachers.

Wilen, W.W. and J.J. White. 1991. "Interaction and Discourse in Social Studies Classrooms." In *Handbook of Research on Social Studies Teaching and Learning*, J.P. Shaver, editor (pp. 483-495). New York: Macmillan.

Chapter 11. Focusing Staff Development on Improving Student Learning

Dennis Sparks

High-quality staff development is essential if teachers are to consistently apply in their classrooms the findings of the research described in this book. Research and experience tell us that widespread, sustained implementation of new practices requires a new form of professional development. The professional development required to meet the challenges provided by the contents of this book must not only affect the knowledge, attitudes, and practices of individual teachers, administrators, and other school employees, but must also alter the cultures and structures of the organizations in which those individuals work.

It is essential that educational leaders who seek to improve the quality of instruction pay attention to organizational change as well as the learning of individual teachers and administrators, so that those activities are coherent and aligned with other reform efforts. "The greatest problem faced by school districts and schools," according to Fullan, is not resistance to innovation, but the "fragmentation, overload, and incoherence resulting from the uncritical acceptance of too many different innovations" (1991, 197).

Elsewhere, I have described this new form of professional development as a "paradigm shift" that is based on three powerful ideas: results-driven education, systems thinking, and constructivism (Sparks 1994). For the purposes of this book, some of the most important of these shifts represent: an increased focus on both organization development and individual development; an inquiry approach to the study of the teaching/learning process by teachers; staff development efforts driven by clear, coherent strategic plans; a greater focus on student needs and learning outcomes; an inclusion of both generic and content-specific pedagogical skills; and the greater recognition that staff development is not a frill, but rather an essential and indispensable part of the reform process.

This chapter offers recommendations based on this paradigm shift regarding the processes of both individual and organizational change, as well as the specific methods that schools may wish to use in promoting the types of instructional approaches described in this book. These recommendations address the various issues that school administrators and teachers designing staff development programs must consider if their goal is improvement in the learning of all students through the application of research by all teachers in all classrooms.

Recommendations

Keep the focus on student learning.

Staff development must be viewed as a means to the end of improved learning for all students, not as an end in itself. According to Joyce, Wolf, and Calhoun, "the centrality of student learning is the driving purpose of all activities.... We did not find a single case in the literature where student learning increased but had not been a central goal" (1993, 19).

Joyce and Showers (1995) concluded that well-designed staff development activities can improve the learning of all students. The research-based recommendations made by the authors of this *Handbook* can provide a focus for such results-oriented staff development. And, according to Joyce, Wolf, and Calhoun, such change efforts are more likely to succeed than those that lack a solid research foundation or that are made too tentatively. "Strong, well supported initiatives are easier to make than are weak ones," the authors observe, "and educators are perfectly capable of rapidly learning the skills and knowledge to sustain the most complex initiatives thus far put forward, provided that adequate support is given" (1993, 6).

Recognize that change affects staff members in personal ways.

Bridges (1991) argues that change has a psychological dimension that he terms "transition." This three-step process includes ending, the neutral zone, and the new beginning. "It isn't changes themselves that people resist...." Bridges writes. "It's the losses and endings that they experience and the transition that they are resisting" (p. 20). He offers many suggestions for helping individuals through the feelings and tasks of the transition process.

The ending phase, Bridges suggests, can be a time of anger and sadness. People identify specifically what has been lost—including unstated beliefs and assumptions about the way things are—and what will stay the same. The losses should be brought out into the open and listened to sympathetically.

The neutral zone is often characterized by anxiety. While a human tendency is to rush through the discomfort of the neutral zone as quickly as possible, Bridges argues that, if appropriately experienced, it can be a time of creative response to the challenges of change. Leaders can help those in the neutral zone by acknowledging that it is a normal part of the transition process, during which necessary reorientations are taking place, both for the individual and for the organization.

Bridges suggests that beginnings be approached by applying the "four Ps": establish a *purpose* for the change, paint a *picture* of how the new outcome will look and feel, lay out a step-by-step *plan* for phasing in the outcome, and give each individual a *part* to play in the process.

Hord and others (1987) also view change as a highly personal process, one that involves developmental growth in feelings and skills. In what has been called the Concerns-Based Adoption Model (CBAM), the authors describe how individuals progress through a predictable set of concerns as they become engaged in using a new practice. Individuals typically focus on concerns oriented toward themselves in which they express a desire to acquire more information about how the change will affect them personally. Next come task concerns, which focus on how to successfully manage the new practice. The final set of concerns—which may take as much as two years to surface—focuses on impact. During these stages individuals look at how the new practice is affecting students, how it can be related to what others are doing, and how the practice can be improved. By understanding the stage of concerns experienced by individuals or a group, school leaders can tailor staff development to address those particular issues. For example, providing sessions in which teachers share successful techniques for using portfolios with students can help alleviate task concerns.

Another aspect of the personal dimensions of change is the importance of providing individual teachers with opportunities to make personal sense of the proposed change. "The main reason for failure is simple," says Fullan. "Developers or decision makers went through a process of acquiring their meaning of the new curriculum. But when it was presented to teachers, there was no provision for allowing them to work out the meaning of the change for themselves" (1991, 112). That means that teachers need generous amounts of time to discuss the rationale for the strategies they will need to use and to acquire a deeper understanding of the process. Without that shared meaning, widespread implementation is likely to falter.

Change the organization's culture at the same time that individual teachers and administrators are acquiring new knowledge and skills.

It is essential that school leaders recognize the power of the organization—its roles, processes, and structures—to shape the behavior of individuals (Joyce 1990). Senge (1990) argues that organizations must continually adapt through the learning of their members or risk failure and extinction. The "learning organizations" he describes possess five "disciplines":

- systems thinking (described below);
- personal mastery (continually clarifying what is important and continually learning how to see current reality more clearly);
- mental models (recognizing the power of internal images in shaping practice);
- shared vision (tapping in to people's desire to be connected to an important undertaking); and

- team learning (using dialogue to help team members suspend their assumptions while at the same time communicating these assumptions freely).

In these disciplines Senge is recognizing the power of collective processes and organizational structures to affect individual performance.

School districts and schools are complex organizations whose cultures promote certain behaviors and inhibit others. Staff development that focuses exclusively on the behavior of individual teachers without recognizing the influence of the organization in supporting or stifling new practices is destined for failure.

To become learning organizations, schools must engage in organization development activities (Schmuck and Runkel 1988). According to Walters (1990), organization development is a process of planned change in which the change is defined and owned by the client organization (in this case the school or school system). It is a long-term systemic process rather than a one-time intervention. Organizational development is based on continual data collection, analysis, and feedback, and focuses on the development of groups, as well as individual development that would improve group functioning. In addition, organization development improves the organization's capacity to solve future problems.

Use a systems approach to change.

Every organizational grouping—which includes classrooms, schools, and school systems —is made up of parts (Bonstingl 1992). In essence, systems theorists believe that everything in a system is connected to everything else, and that a change in any part affects all the other parts and the whole.

"Systems thinking is a discipline for seeing wholes," Senge writes. "It is a framework for seeing interrelationships rather than things" (1990, 69). Senge stresses the importance of looking beyond personalities and events and seeing the structures in which employees operate so that the unseen forces that limit progress can be addressed and changed. Because employees do not usually see the structures or realize their power, they often find themselves compelled to act in certain ways.

Without this knowledge of systems, Senge points out, "The harder you push, the harder the system pushes back" (1990, 58). He also notes, however, that small changes applied at the points of greatest leverage can produce big results, but that these points are often the least obvious because of our attention to symptoms rather than underlying causes.

School improvement has often suffered from the very antithesis of systems thinking—a "project mentality" that attempted to isolate parts of the system for special attention while ignoring the remainder of the system. A project might address one particular aspect of the curriculum (for example, elementary mathematics) or of instruction (for example, cooperative learning) without considering how those elements affect and are affected by other parts of the system. For instance, changing the elementary mathematics curriculum without simultaneously considering changes in assessment or instructional skills is likely to lead, at best, to partial implementation of the new curriculum.

Apply what is known about the change process to the improvement effort.

Loucks-Horsley (Sparks 1990) points out that there are four components that must be addressed during the change process: *people*, *processes*, *practices*, and *policies*. The first of these, *people*, was addressed above in the discussion of the Concerns-Based Adoption Model.

According to Loucks-Horsley, the second component, *processes*, focuses on three phases of the change process: initiation, implementation, and institutionalization. During the initiation phase, participants' "self concerns" (What is this new practice and what does it mean to me?) must be addressed. It is critical that teachers be given a clear image of the new practice, that expectations be made clear, and that they be involved in whatever decisions are possible regarding the practice. During the implementation phase, Loucks-Horsley recommends that "management concerns" (How do I do it?) be addressed through a great deal of follow-up and in-classroom support. The institutionalization phase requires that the base of support for the new practices be broadened beyond the program's initial advocates to a team of teachers and administrators. Mechanisms for ongoing support need to be provided; these include a line item in the budget and the rewriting of curriculum and assessment processes, if necessary.

Loucks-Horsley's third component, *practices*, reminds school leaders that certain characteristics of new practices make them easier to use. These characteristics include a clear definition of what the practices should look like in the classroom, classroom friendliness, and evidence that the practices do indeed make a difference in student learning.

Finally, *policies* establish the parameters for the new practices. These parameters may sometimes be expressed as mandates, which Loucks-Horsley views as being valuable in "unfreezing" the system, assuming that adequate support is provided in fulfilling the mandate.

Fullan (Sparks 1992) reminds educators to be aware of the "implementation dip" during which performance worsens before it improves; the transition period between the old practice and the new may be fraught with tension as teachers experience the typical problems of implementing innovations. Joyce, Wolf, and Calhoun (1993) found that this normal anxiety can be reduced through the social support provided by study group/peer coaching arrangements.

Recognize the subtle tension between the importance of establishing readiness for change and the need to get people to try out new practices.

Wood (1989) emphasizes the importance of teachers being psychologically and intellectually ready for the change process of which they are a part. When change efforts are begun abruptly, resistance may be unnecessarily heightened and implementation slowed or stalled. Wood's recommendations for establishing readiness include establishing a positive school climate, collaboratively establishing goals, examining current school practices to determine which are congruent with the school's improvement goals, and making a commitment to new behaviors and programs.

Calhoun (1994) believes that six conditions should be established to support the successful implementation of action research, one particular form of instructional improvement process: 1) a faculty that seeks a better education for all students, 2) a public agreement about how collective decisions are made, 3) a facilitation team that is willing to lead the action research process, 4) study groups or liaison groups that meet regularly, 5) awareness and some understanding of the action research cycle, and 6) technical assistance.

While preparation for change is important, it must be balanced against the value of actively engaging teachers in the use of new practices so that they can see the positive effects on their students' learning. According to Guskey (1986), teachers' attitudes about innovations improve when they have evidence provided in their own classrooms that the new practices are effective with their students. Guskey's findings serve as a caution against overly extended preparation for new initiatives.

Provide content-specific staff development that addresses both deeper forms of content knowledge and instructional strategies most effective in that discipline.

A great deal of staff development during the past 15 years has been generic—that is, it has been provided to K-12 teachers across grade levels and disciplines in identical or nearly identical ways. Cooperative learning and Madeline Hunter-type training were two common examples of that approach.

While generic staff development programs have their place and have made valuable contributions, the research presented in the preceding chapters requires that teachers have extended opportunities to study the research pertaining to various disciplines so that they understand the content in deeper ways and are better able to detect common misconceptions of students. In addition, teachers must be provided with sufficient time to adapt generic instructional processes to their subject areas and to learn about the specific techniques that are most appropriate to that discipline.

Make certain that the learning process for teachers models the type of instruction that is desired.

Because example is such a powerful teacher, it is critical that staff development not only provides a deeper understanding of the various disciplines and their pedagogy, but that it also provides a model of the desired practices. For instance, teachers who are preparing to teach from a constructivist perspective will benefit most from staff development that incorporates that perspective, providing abundant opportunities for the construction of teachers' knowledge through discussion, journal writing, hands-on experiences, and similar processes (Sparks 1994).

Encourage various forms of job-embedded learning.

The task of changing the instructional practices of teachers is typically underestimated in terms of its complexity and the sustained effort that is required on several fronts if staff development is to affect the learning of all students. When educators think of staff development, they tend to think of workshops for teachers. As a result, the most common means for attempts to improve instruction is the training program. In the past 15 years, these programs have become more effective by increasing the number of training sessions, providing opportunities for participants to try out new practices in their classrooms, and providing follow-up coaching in classrooms by peers and experts (Sparks 1994; Joyce and Showers 1995).

But staff development includes processes other than training. For instance, Sparks and Loucks-Horsley (1989) identify five models of teacher development: 1) individually guided, 2) observation/assessment, 3) involvement in a development/improvement process, 4) training, and 5) inquiry. These models acknowledge that important learning can occur in various ways, and that training should not be the only form of learning provided.

Non-training forms of learning recognize the power of learning that occurs closest to teachers and students in classrooms. These job-embedded forms of learning include the joint preparation of lessons, the critiquing of students' work, the observation of peers, coaching, and participation in study groups and action research (Calhoun 1994; Joyce, Wolf, and Calhoun 1993).

When training is the learning mode that is being used, make certain that it is well designed and includes sufficient follow-up support in the classroom over a sustained period of time.

Joyce, Wolf, and Calhoun (1993) point out that poor design of training and follow-up is a primary reason for the low level of implementation of new practices by teachers. They suggest that major innovations may require 10 to 15 days of training rather than the one or two that are typically provided.

Effective workshops, according to Joyce, Wolf, and Calhoun, provide teachers with a deep understanding of the conceptual base of the new strategy and its effects on students. They contend that demonstration is the "fulcrum of training design"; teachers require about 20 demonstrations of the strategy, about half of which should be videotapes of students. In addition, teachers need workshop opportunities to practice the new skill, especially the "opening moves." Even with these training elements in place, the authors point out, fewer than 10 percent of these desired instructional practices will be added to teachers' repertoires unless workplace redesign is undertaken.

Among those workplace redesigns that complement training by promoting transfer to the classroom are coaching and action research. When the goal of training is transfer of skills from the workshop to consistent, correct use in the classroom, Joyce and Showers (1995) underscore the critical importance of participants understanding the theoretical base of the skill, viewing numerous demonstrations of the practice, practicing the skills with feedback, and receiving on-the-job coaching. "A large and dramatic increase in transfer of training...." Joyce and Showers write, "occurs when in-class coaching is added to an initial training experience comprised of theory explanation, demonstrations, and practice with feedback" (1995, 112). This type of training enhances teachers' fluency with the new skill, improves their executive control over its use, and increases their confidence as they integrate the skill with ongoing instructional practices.

Provide generous amounts of time for collaborative work and various learning activities.

"We recommend that teachers be provided with the professional time and opportunities they need to do their jobs," the National Education Commission on Time and Learning concluded (1994a, 36). A fundamental lesson about school reform from the past decade is that far more time is required for staff learning and collaborative work than is currently available. Staff development days—typically for workshops—and brief meetings before, during, or after the school day when other responsibilities tug at the participants are grossly insufficient for the collegial learning and planning that are essential to successful teacher-led improvement efforts.

A follow-up publication from the National Education Commission on Time and Learning argues that "the Commission's study of time and learning in schools clearly and consistently points to a need for more and better time for teacher learning" (1994b, 39). The Commission points out that this time is needed for teachers to master their subjects, design learning experiences for students that result in the achievement of high academic standards, use improved assessment systems, and work with and learn from colleagues. "To lock teachers into the existing system, which defines a teacher's professional activity almost solely as the time spent in front of students in classrooms, is to guarantee failure," the latter report notes (p. 39).

Hugh Price (1993), formerly vice president of the Rockefeller Foundation and currently president of the National Urban League, argues that an important barrier to providing time for teacher development is our uncertainty about what to do with students while teachers are away from their classrooms. For that purpose, he proposes "academically productive ways" students could spend the equivalent of one day a week away from their regular teachers that "wouldn't cost the district a bundle." Price suggests as possible options school-based extracurricular activities, occasional large classes, course-related projects (higher-order assignments), and community service.

Purnell and Hill (1992) and Raywid (1993) suggest various ways that time can be found for staff development. Their recommendations include using existing time (such as faculty and department meetings) more productively, implementing schoolwide community service projects that would free most of the staff for collaborative work, extending the school day for a few minutes four days a week with an early release day on the fifth day, and adjusting the master schedule to accommodate team meetings during the school day.

Conclusion

Schools can improve the learning of all students through well-designed staff development activities. The content of this book can provide the basis for such an effort. Administrators and teacher leaders can begin by working together to transform the culture of their schools. They can also make decisions together about the objectives, content, and processes of their professional development experiences. By providing generous opportunities for teacher learning and collaboration, and by altering the culture and structures of the schools in which they work, teachers can and will improve teaching and learning in ways that truly benefit all students. To accomplish that end, professional development must be viewed as an essential and indispensable part of the school improvement process.

References

Bonstingl, J.J. 1992. *Schools of Quality.* Alexandria, VA: Association for Supervision and Curriculum Development.

Bridges, W. 1991. *Managing Transitions.* Reading, MA: Addison-Wesley.

Calhoun, E. 1994. *How to Use Action Research in Schools.* Alexandria, VA: Association for Supervision and Curriculum Development.

Fullan, M., with S. Stigelbauer. 1991. *The New Meaning of Educational Change.* New York: Teachers College Press.

Guskey, T. 1986. "Staff Development and the Process of Teacher Change." *Educational Researcher* Vol. 15, No. 5: 5-12.

Hord, S., W. Rutherford, L. Huling-Austin, and G. Hall. 1987. *Taking Charge of Change.* Alexandria, VA: Association for Supervision and Curriculum Development.

Joyce, B. (editor). 1990. *Changing School Culture Through Staff Development.* Alexandria, VA: Association for Supervision and Curriculum Development.

Joyce, B. and B. Showers. 1995. *Student Achievement Through Staff Development, 2nd edition.* White Plains, NY: Longman.

Joyce, B., J. Wolf, and E. Calhoun. 1993. *The Self-Renewing School.* Alexandria, VA: Association for Supervision and Curriculum Development.

National Education Commission on Time and Learning. 1994a. *Prisoners of Time.* Washington, DC: U.S. Government Printing Office.

National Education Commission on Time and Learning. 1994b. *Prisoners of Time Research: What We Know and What We Need to Know.* Washington, DC: U.S. Government Printing Office.

Price, H. 1993. "Teacher Professional Development: It's About Time." *Education Week* (May 12, 1993).

Purnell, S. and P. Hill. 1992. *Time for Reform.* Santa Monica, CA: RAND Corporation.

Raywid, M. 1993. "Finding Time for Collaboration." *Educational Leadership* Vol. 51, No. 1: 30-34.

Schmuck, R. and P. Runkel. 1988. *The Handbook of Organization Development in Schools*. Prospect Heights, IL: Waveland Press.

Senge, P. 1990. *The Fifth Discipline*. New York: Doubleday Currency.

Sparks, D. 1990. "What We Know About Change in Schools: An Interview with Susan Loucks-Horsley." *The Developer* (September 1990): 1.

Sparks, D. 1992. "Understanding the Change Process: An Interview with Michael Fullan." *The Developer* (February 1992): 3.

Sparks, D. 1994. "A Paradigm Shift in Staff Development." *Journal of Staff Development* Vol. 15, No. 4: 26-29.

Sparks, D. and S. Loucks-Horsley. 1989. "Five Models of Staff Development for Teachers." *Journal of Staff Development* Vol. 10, No. 4: 40-57.

Walters, P.G. 1990. "Characteristics of Successful Organization Development: A Review of the Literature. In *The 1990 Annual Developing Human Resources*, J.W. Pfeiffer, editor (pp. 209-223). San Diego, CA: University Associates.

Wood, F. 1989. "Organizing and Managing School-Based Staff Development." In *Staff Development: A Handbook of Effective Practices*, S.D. Caldwell, editor. Oxford, OH: National Staff Development Council.

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